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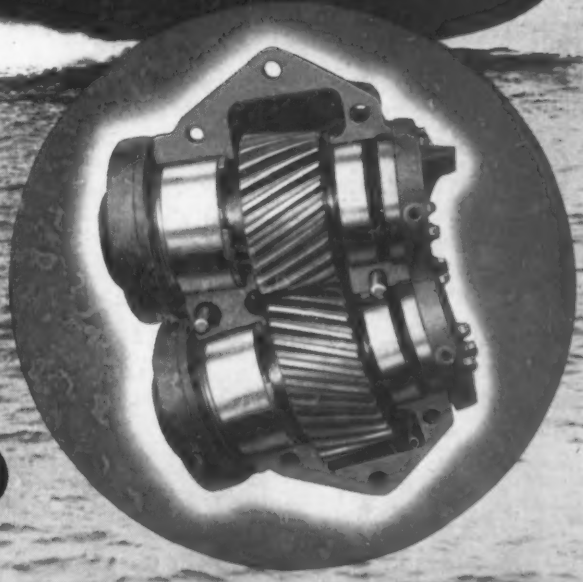

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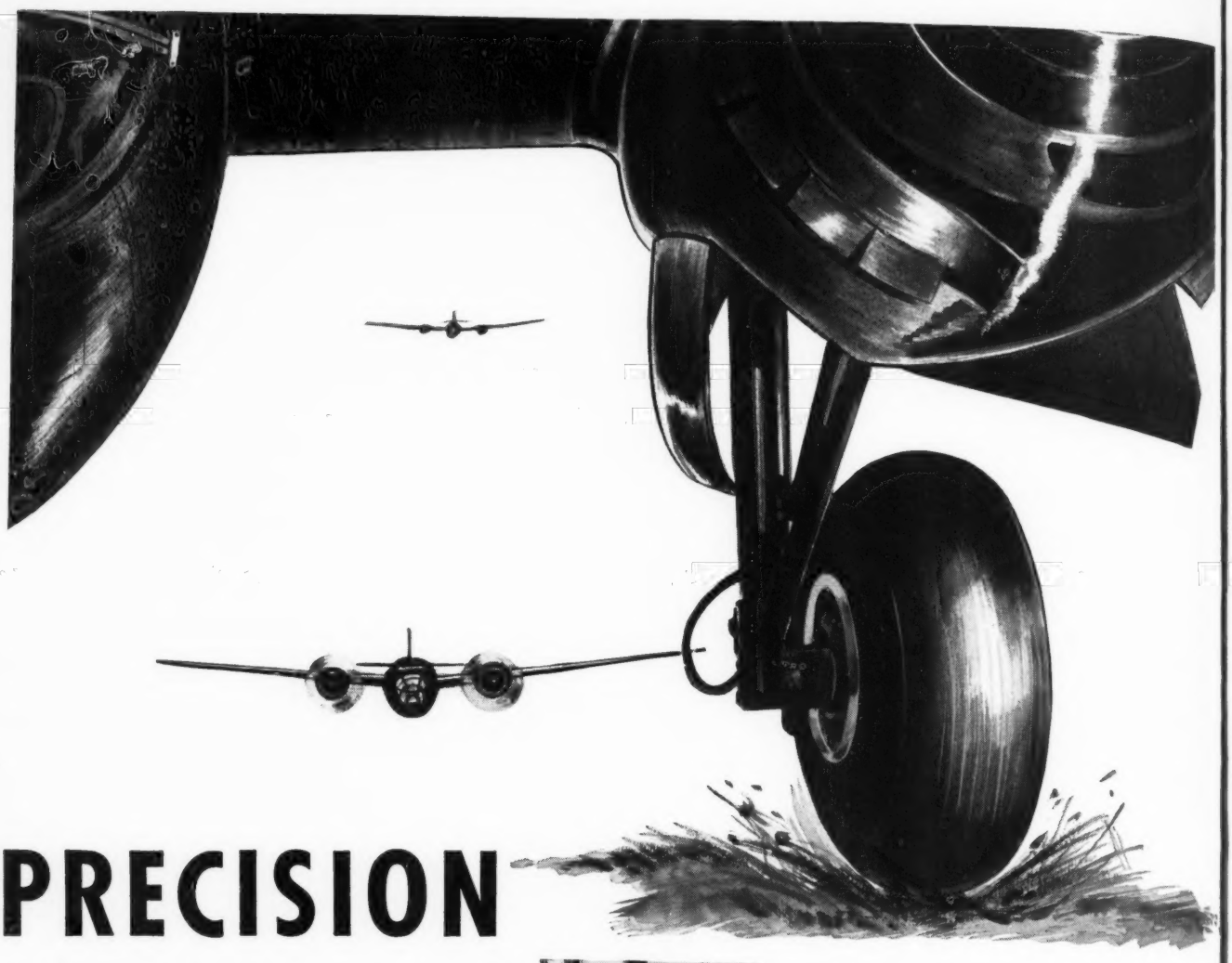

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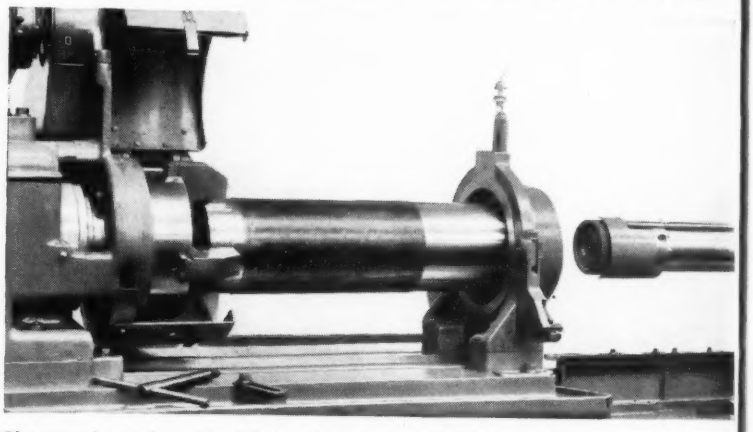

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MACHINERY

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TOTAL DISTRIBUTION
20,425

PUBLISHED MONTHLY BY
THE INDUSTRIAL PRESS
148 Lafayette Street, New York, 13, N. Y.
ROBERT B. LUCHARS ..... *President*
EDGAR A. BECKER.. *Vice-pres. and Treasurer*
ERIK OBERG ..... } *Editors*
FRANKLIN D. JONES..... }
CHARLES O. HERB..... *Managing Editor*
FREEMAN C. DUSTON.... *Associate Editor*
HOLBROOK L. HORTON.... *Associate Editor*
WALTER E. ROBINSON *Advertising Manager*
BRIGHTON, ENGLAND:
MACHINERY, 17 Marine Parade

SUBSCRIPTION RATES: United States and Canada, one year, $4; two years, $7; three years, $8 (for Canada add 25 cents per year for war tax); foreign countries, $7 a year. Single copies, 40 cents. Changes in address must be received by the fifteenth of the month to be effective for the next issue. Send old as well as new address.
Copyright 1943 by The Industrial Press.
Entered as second-class mail matter, September, 1894, at the Post Office, New York, N. Y., under the Act of March 3, 1879.
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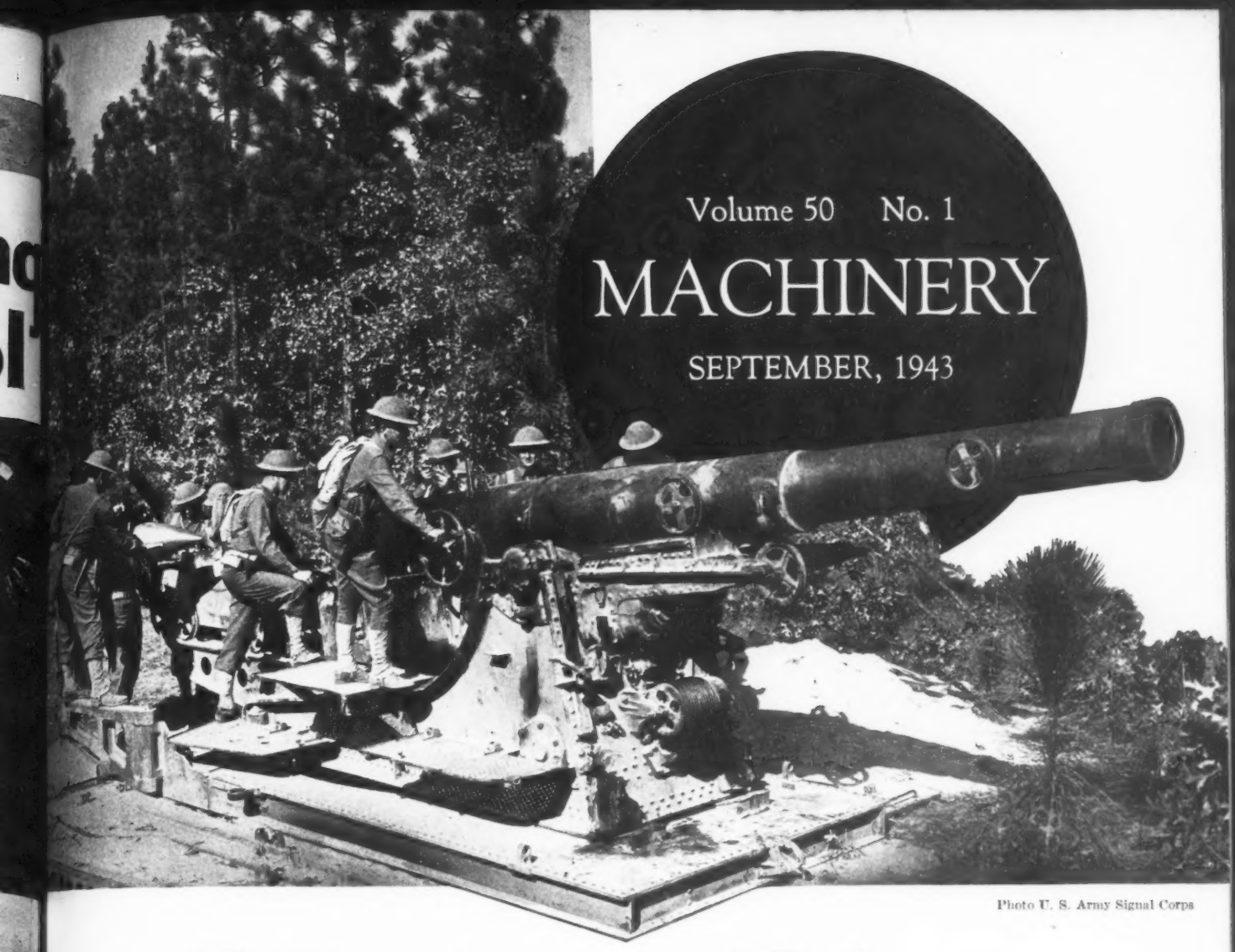


Photo U. S. Army Signal Corps

Making Shells

FOR THE LARGEST MOBILE HOWITZER IN THE WORLD

By HOLBROOK L. HORTON

FORGING and machining shells is not a new task for the American Car and Foundry Co., as during the first World War large quantities of 8-inch, 9.2-inch, 240-millimeter, and 10-inch shells were turned out in several of this company's plants for the Allied Fighting Forces.

With this experience as a background, the company was ready when the need arose to again convert its Buffalo plant to shell production early in 1940. The first shell to be manufactured in this plant for World War II was the British 9.2-inch shell. Then followed the British 7.2-inch shell; a little later work was begun on 155-millimeter shell forgings; and now this plant is engaged in manufacturing 240-millimeter shells for what is believed to be the largest mobile howitzer in the world.

This howitzer, developed by the U. S. Ordnance Department, is so large that it has to be drawn in five sections by 10-ton tractors. It will presumably be used for the demolition of strongly protected fixed defenses. The story of the 240-millimeter shell manufacture by this

Schedule of Operations in Making 240-Millimeter High-Explosive Shells

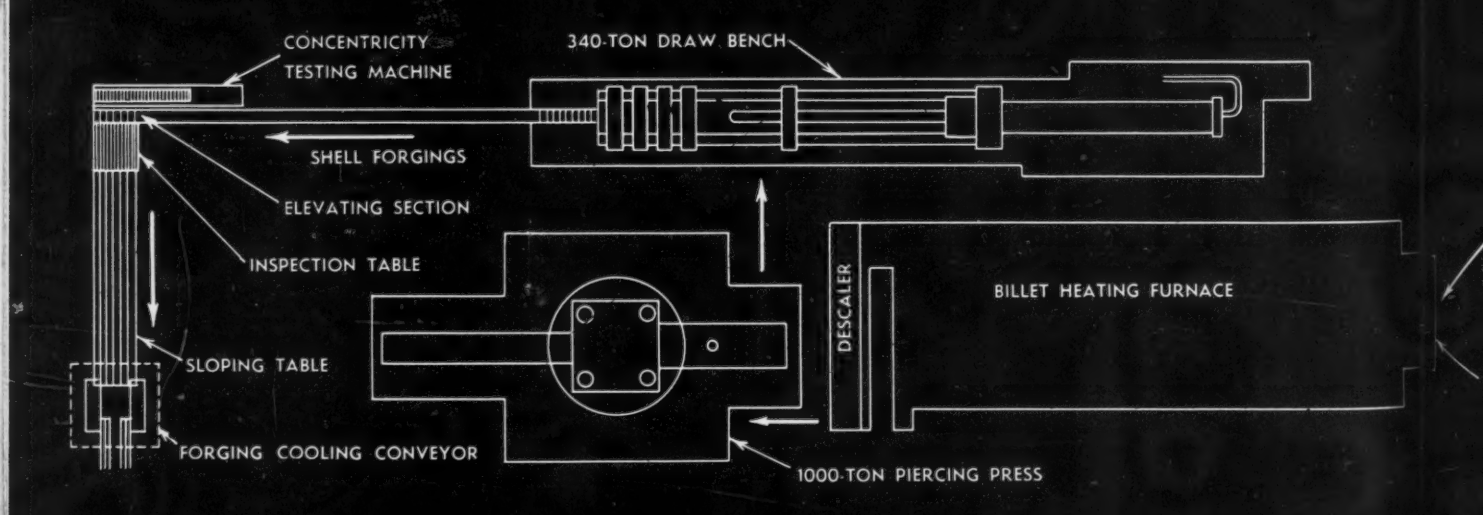
No.	Designation	No.	Designation
A	Weigh bar	13	Face base, turn boat-tail, turn behind band
B	Nicking operation	14	Weigh (No. 3)
C	Fracture into billets	15	"Wave-cut" in band groove
D	Heat for forging	16	Wash and wipe
E	Descale	18	A.C.F. preliminary inspection
F	Forge	19	U.S. preliminary inspection
G	Descale	21	Heat and apply band
H	Draw	22	Turn band
I	Hot inspection	23	Weigh (No. 4)
J	Rotate to cool	24	Face base for weight adjustment
K	Shot-blast interior	25	Apply base cover
L	Cold inspection	26	Stake notch
M	Concentricity test and center	27	Shot-blast
1	Cut off base	28	Wash or degrease
2	Rough-turn	29	Paint interior
3	Semi finish-turn and rough-turn band groove	30	Dry interior
		31	Weigh (No. 5 Final)
4	Remove boss and face base	32	A.C.F. final inspection
5	Weigh (No. 1)	33	U.S. final inspection
6	Heat and close nose	34	Stamp
7	Rough-face and drill fuse hole	35	Apply lifting plugs and mask band
8	Heat-treat	36	Paint exterior
10	Brinell hardness test	37	Dry exterior
11	Rough-machine fuse hole	38	Remove band mask and apply grommet
11A	Finish-machine fuse hole	39	Stencil
12	Finish-turn	40	Lot
12A	Weigh (No. 2)	41	Ship

veteran shell producer is but another indication that American industry can and is providing an adequate supply of the most modern and effective weapons in use today to hasten the victory of the United Nations.

The billets from which the 240-millimeter shells are forged are cut from blooms of Government specified steel, 8.765 inches square and about 126 inches long. The blooms are nicked along one side for a depth of 3/4 to 1 inch with an oxy-acetylene torch on a hand-operated indexing fixture, as shown in Fig. 2. Five forging "mults" or billets are cut from each bloom. After each nicking cut, the bloom is cooled at the cut with a water spray.

Before loading on the roller track to be fed past the nicking torch, the blooms are weighed to make sure that enough metal is present for the billets, which must have a minimum weight of 535 pounds apiece when cut. A P & H 2-ton monorail hoist equipped with a lifting magnet is used to move the blooms from the stock pile to the Toledo live-rail scale, from which they are conveyed to the nicking torch.

Fig. 1. Lay-out of Equipment Employed in Breaking the Bars into Billets and Forging the Billets into Shells. Only



After leaving the nicking torch, the bloom is pushed down a slight incline to the bulldozer, where it is fractured at each notch into billets, as shown in Fig. 3. The bulldozer employed is a Williams & White machine of about 300 tons capacity, multiplied by a self-contained unit to 500 tons. Two men operate the nicking machine and bulldozer and weigh the blooms.

The billets pass from the nicking shed on a conveyor into the forging department, where a 3-ton electric hoist lifts them, after they have been placed on stacking racks, ten billets to a rack, to a position close to the furnace. The billets are picked up individually from the stacking racks by a 500-pound hoist, as shown in Fig. 4, and are placed directly on chrome-nickel alloy steel rails of the heating furnace and are then charged into the furnace chamber. The billets are separated by sheets of asbestos paper to prevent them from sticking together.

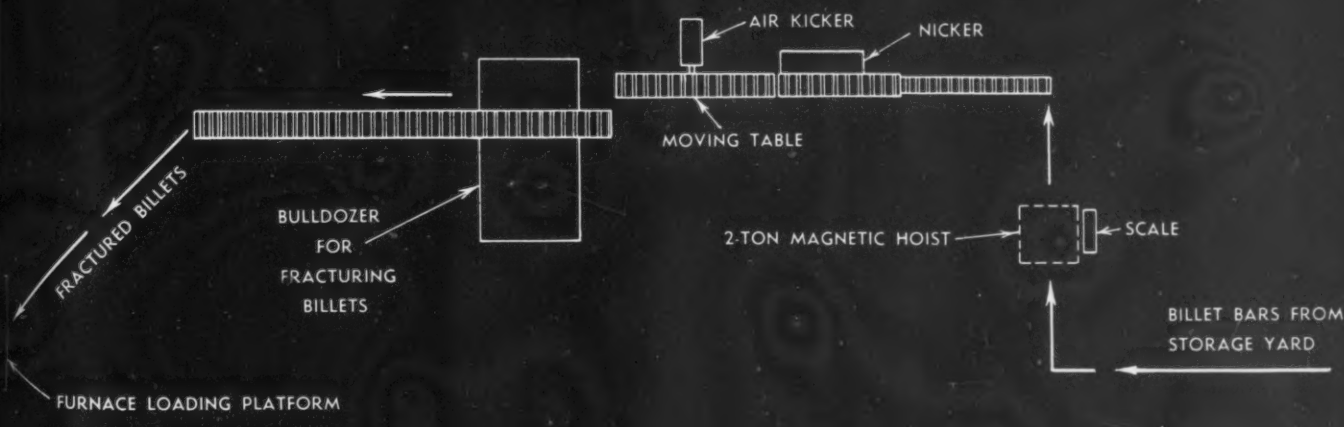
The furnace chamber is 34 feet long and 8 feet 6 inches wide, and charging is accomplished by means of 20-inch diameter pistons with a 30-inch stroke operating at 90 pounds per square inch air pressure. The furnace has three tracks, each of which accommodates forty-two or forty-three billets at one time. Six Anthony burners fire from each side, and a slightly oxidizing atmosphere is maintained to insure that any scale formed will be free and easy to remove. The furnace temperature is maintained at 2250 degrees F. The temperature of the billets rises to a maximum of 2200 degrees F., and they are soaked at this temperature to assure full penetration of the heat and even temperature throughout the billet.

When thoroughly heated, the billet is pushed out of the furnace chamber onto a V-shaped trough at the front. A pneumatic pusher moves the billet across the furnace front through a hydraulic multi-jet descaler, operating at a pressure of 1500 pounds per square inch. It is then turned through 45 degrees on a rotating section of track and is pushed into an ingenious lifting device devised by the American Car and Foundry Co. This device consists of a long arm pivoted near the base of the forging press and worked by a piston from an air cylinder deep in the pit. The billet is taken by the carrier, as shown in Fig. 5, and swung over to the die pot (which has been moved out from underneath the press), where it is dropped into place.

A toggle arrangement was formerly used to hold the billet in the carrier, but this was found unnecessary, as when the billet was swung over, the resulting centrifugal force tended to hold the billet firmly in the carrier until it was in a vertical position over the die pot. The top of the die pot is faced with a shock-resistant alloy to withstand the impact of the dropped billets. The billet as it comes to the forging press after passing through the descaling unit is in an exceptionally clean condition.

The Baldwin Southwark press used for the piercing operation had an original capacity, with pull-backs in service, of 850 tons. The pull-backs were valved off, however, and a capacity of 1000 tons was obtained. The piercing press operates at a pressure of 1500 pounds per square inch. Fig. 6 shows the piercing punch ready to be forced down into the die pot containing the hot billet. The billet is completely pierced with one

Seven Men are Needed to Operate the Equipment Shown and to Move the Billets and Shells along the Conveyor Track



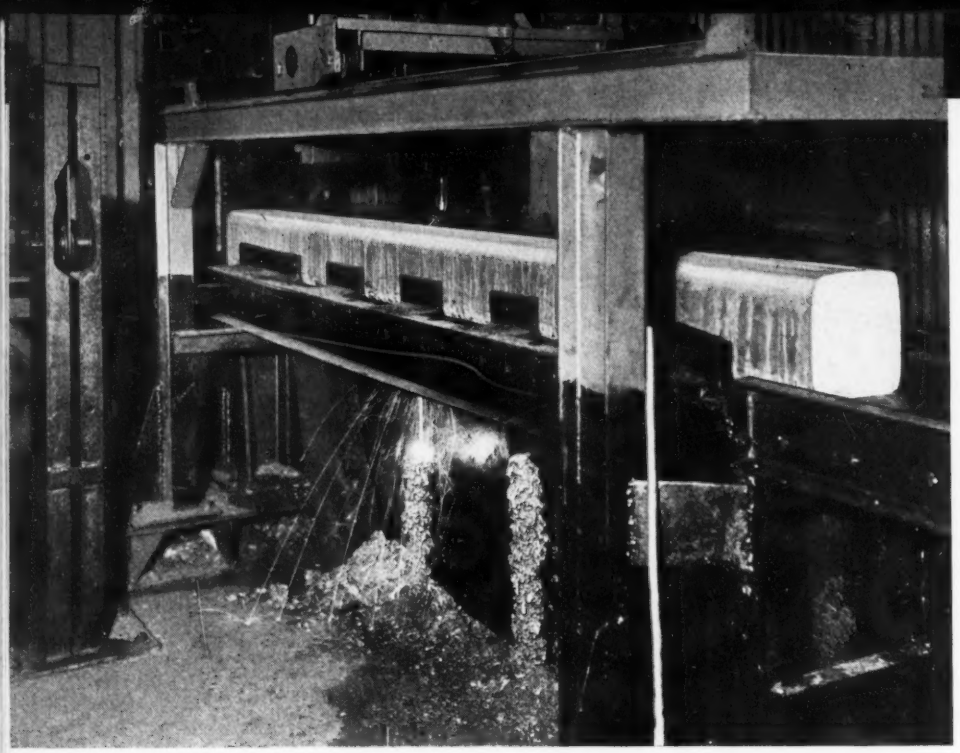


Fig. 2. This Bar, 126 Inches Long, is being Nicked along One Side with an Oxy-acetylene Torch to Facilitate Fracturing. Five Forging Billets will be Broken from Each Bar

stroke of the press, and a cylindrical shell or bottle is formed with a flat end having a slight boss in the center.

The details of the forging die assembly are shown in Fig. 8. In this illustration, the piercing point is shown at the lower end of its stroke. The opening in the side of the die-pot guide cap, as shown in Fig. 6, permits the die pot to be moved out from underneath the press for loading and unloading without further retraction of the piercing point.

After retraction of the piercing point, the die pot is moved out from under the press, and the forged bottle is raised and pulled over on a track on which it passes through another hydraulic descaler. It then rolls onto the draw-bench. After unloading, the die pot without further movement is ready and in position to receive a fresh billet from the carrier.

The forging is then pushed through four rings of a Baldwin Southwark draw-bench, shown in Fig. 7, in one pass to bring it to the desired diameter. The draw mandrel and rings are made of an American Car and Foundry nickel cast-iron alloy, as are also the die-pot liner and piercing point. In the case of the latter, although the cast-iron alloy was found not to last for as many operations as steel, it proved to be more economical because of lower initial cost. When repeatedly heated by contact with the billets, some checking of the piercing point surface occurs, but this has not affected the interior surface of the forging, as finally drawn.

One factor of interest in connection with this

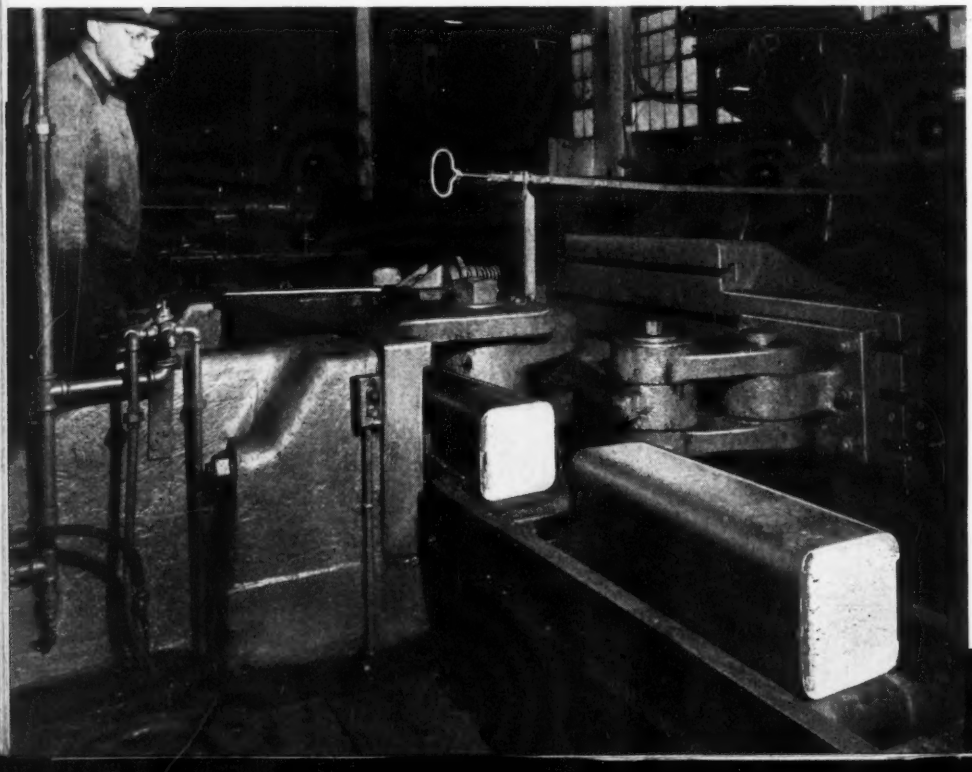


Fig. 3. Billet as It Leaves 500-ton Bulldozer after Fracturing. The Dark Left-hand Edge of the Fracture Shows the Depth of the Oxy-acetylene Nicking Cut

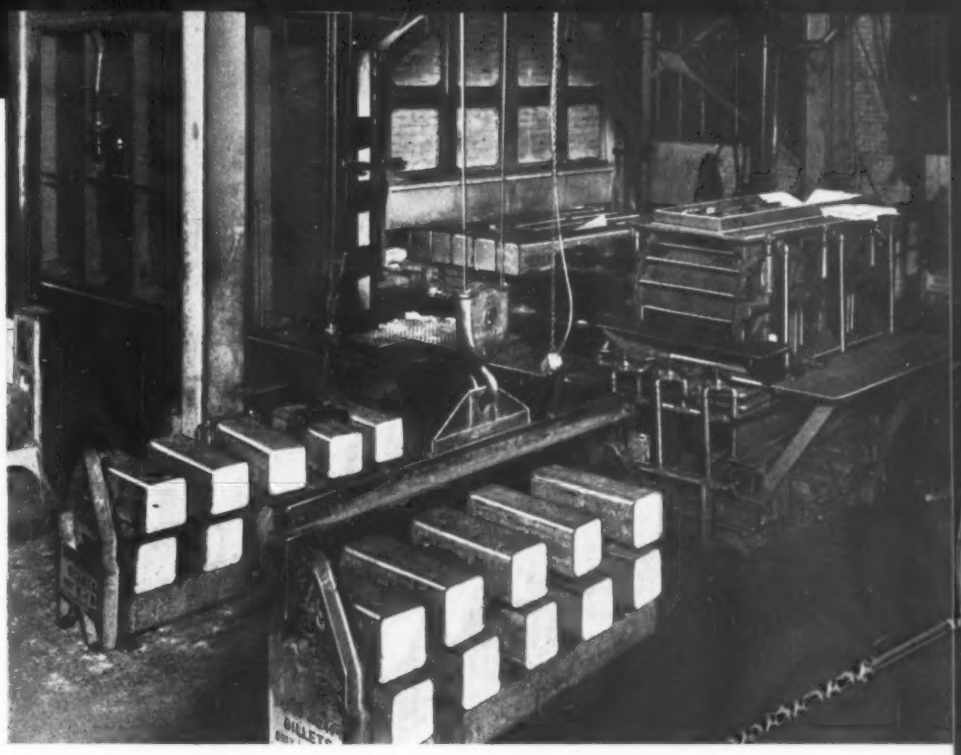


Fig. 4. Billets are Loaded Individually on Furnace Rails, and are Charged into Furnace by 30-inch Stroke Pistons. Asbestos Paper between Billets Prevents Their Sticking together

entire succession of heating operations is that only five men are required—two on the furnace and three on the press and draw-bench. Throughout the plant, this economy in the use of direct labor and a rigid restriction of indirect labor has been achieved to an impressive degree.

From the draw-bench the forging passes down a roller conveyor to the inspection bench. Here it is lifted on a movable section of conveyor up to bench level, where it is tested for concentricity, base taper cavity, inside diameter, internal length, and base thickness. The test for concentricity is shown being conducted in Fig. 9. The inside diameter of the forging is held within plus or minus 0.0075 inch.

From the inspection station, the forging is pushed on a moving Link-Belt cooling conveyor. Here, each forging is rotated as it is slowly carried along in a horizontal position. Rotation of the heated forgings prevents them from assuming an elliptical shape in cooling. The cooled forgings are delivered to an outside storage area, where they are stored according to their original steel mill heat.

Throughout the production line, the forgings and shells are kept segregated by steel mill heats. Thus, if inspection reveals defects in any shell traceable to the steel, the entire heat can be readily re-examined. Another advantage of segregating the forgings and shells by heats is that the different analyses of steel can be arranged to pass through the heat-treating draw-furnace in such an order that the changes in drawing temperature, if required, will be small

Fig. 5. White-hot Billet being Delivered to Forging Press Die Pot by an Ingenious Carry-over Arm. The Die Pot has been Moved out to Receive the Billet

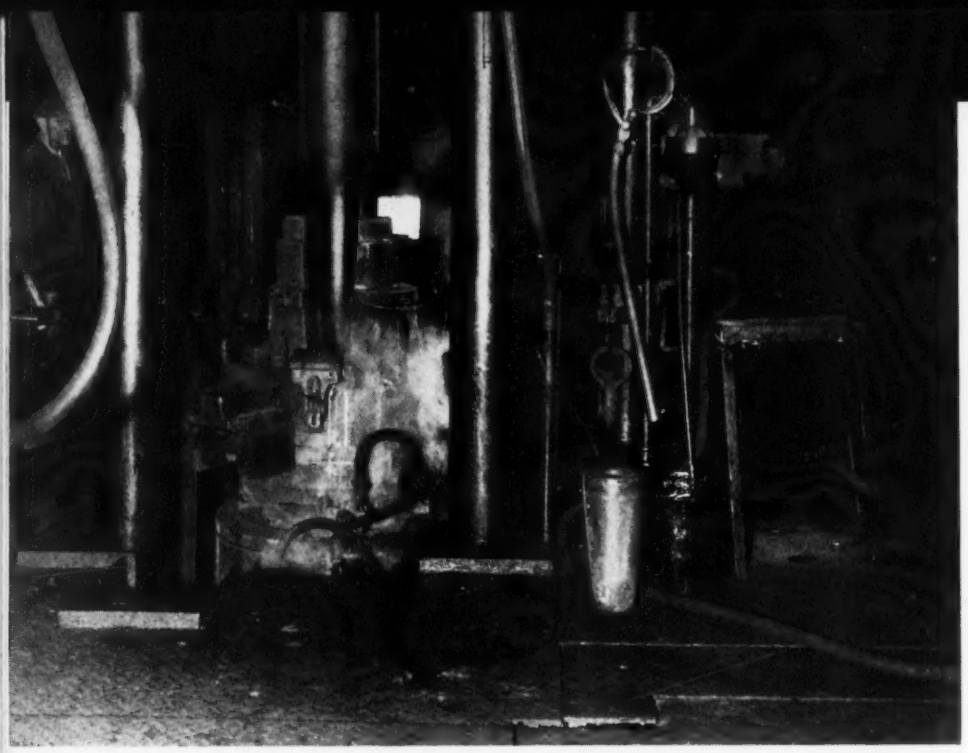


Fig. 6. Piercing Punch about to Descend for Forging Billet into Shell in Single Stroke. Piercing Points are of Alloy Cast Iron. One that has Just been Replaced is Shown in Foreground at Right

and in the same direction, that is, either up or down, facilitating the heat-treating operation.

When taken from the outdoor storage area, the forging is placed in a Sly shot-blasting machine, where its interior is cleaned with No. 20 chilled steel grit. On leaving the shot-blasting machine, it is again inspected with gages for taper cavity, inside diameter, internal length, and base thickness. A hand-grinder is used to remove any blemishes, and they are few, from the cavity.

It is then lifted on an elevator section of conveyor track to track level, where it is taken to a concentricity testing and centering machine. This machine is a converted Lodge & Shipley 30-inch engine lathe. Four arms with rollers are swung into contact with the exterior of the forging as it is revolved. These rollers actuate vertical indicators which show irregularities in the concentricity at four points along the length of the forging. At the same time, a center hole is drilled and countersunk in the boss on the closed end of the forging.

The forging then passes down a roller conveyor to a series of machining operations. Movement of the forgings (now called shells) along this conveyor is handled entirely by the machine operators. They lift the shells on and off the conveyor by means of small pneumatic or chain hoists.

In the first operation, the base is faced, and the open end is squared and cut to length. The cutting is done with the shell rotating at a speed of from 32 to 36 R.P.M., using a feed of about

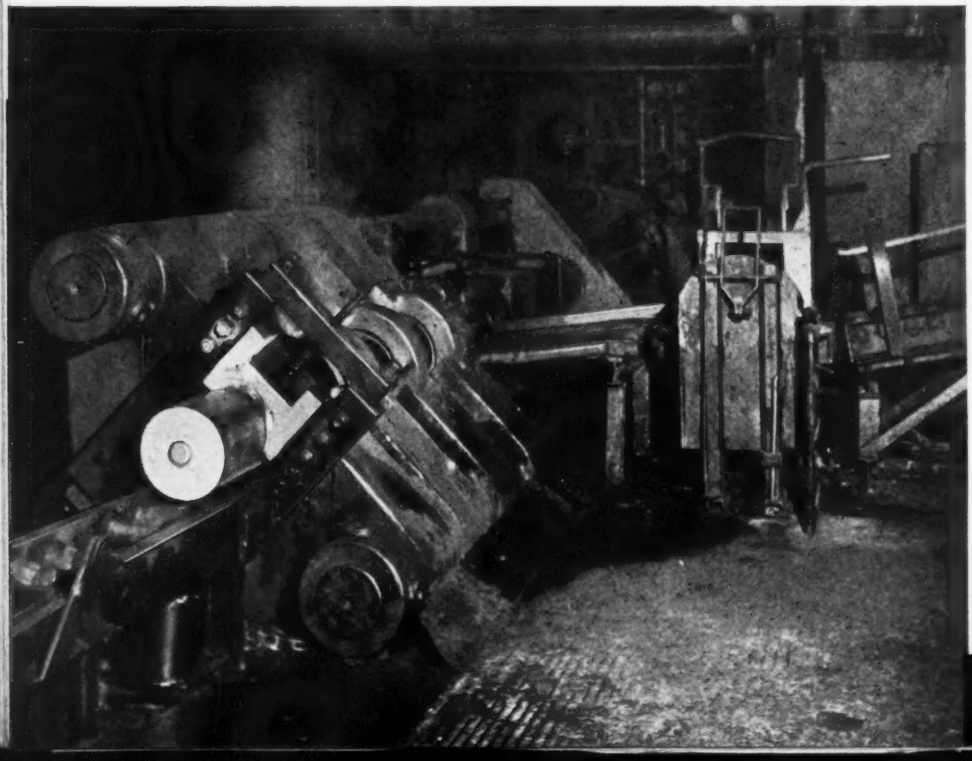


Fig. 7. Shell Emerging from Draw-bench after being Pushed through Four Reducing Rings in One Pass. Located between the Runways in the Right Background is a Hydraulic Descaler

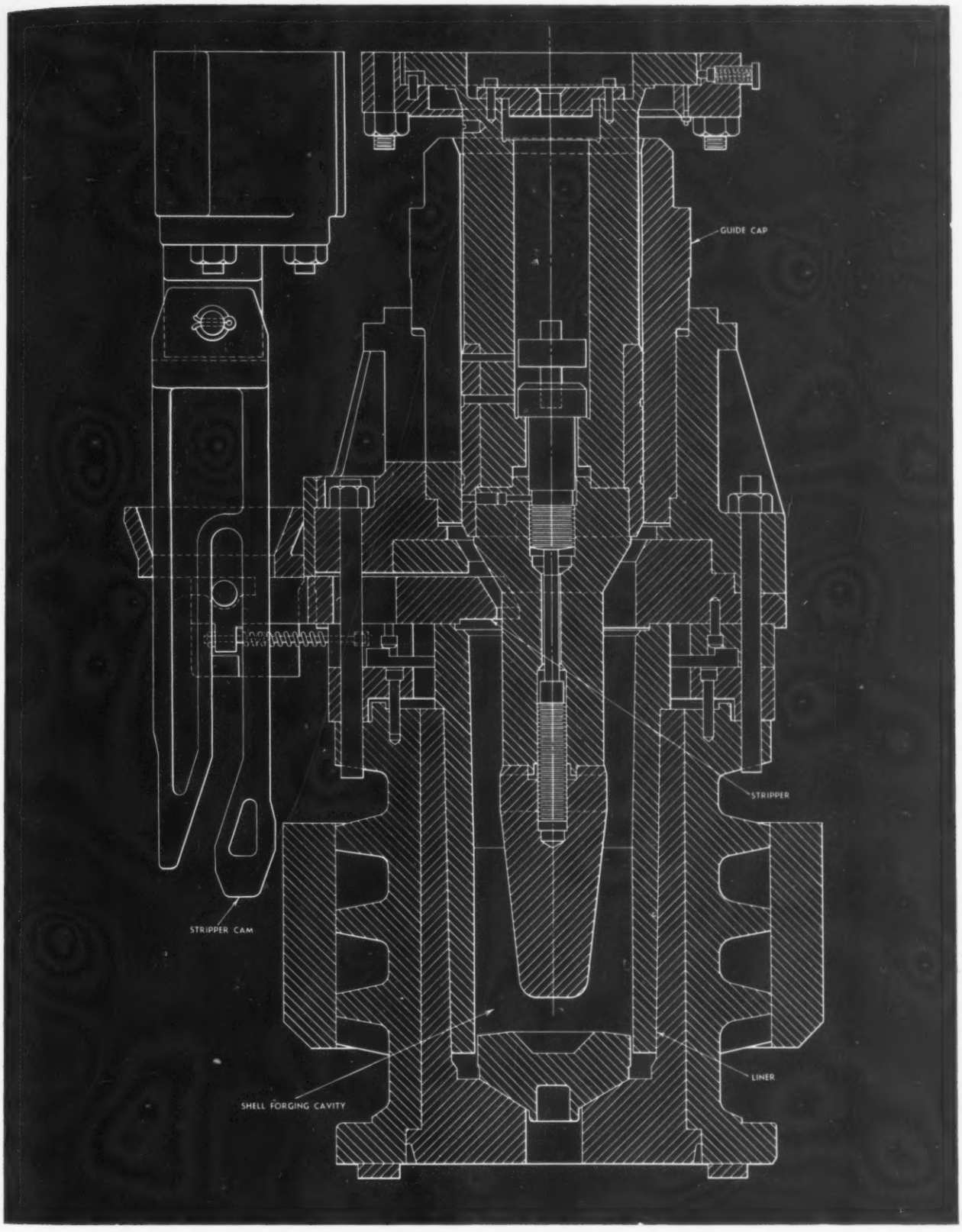


Fig. 8. Details of Forging Die Assembly, Showing Replaceable Piercing Point and Stripper Arrangement. Both the Piercing Point and the Die-pot Liner are Made of a Nickel Cast-iron Alloy Developed by the American Car and Foundry Co.

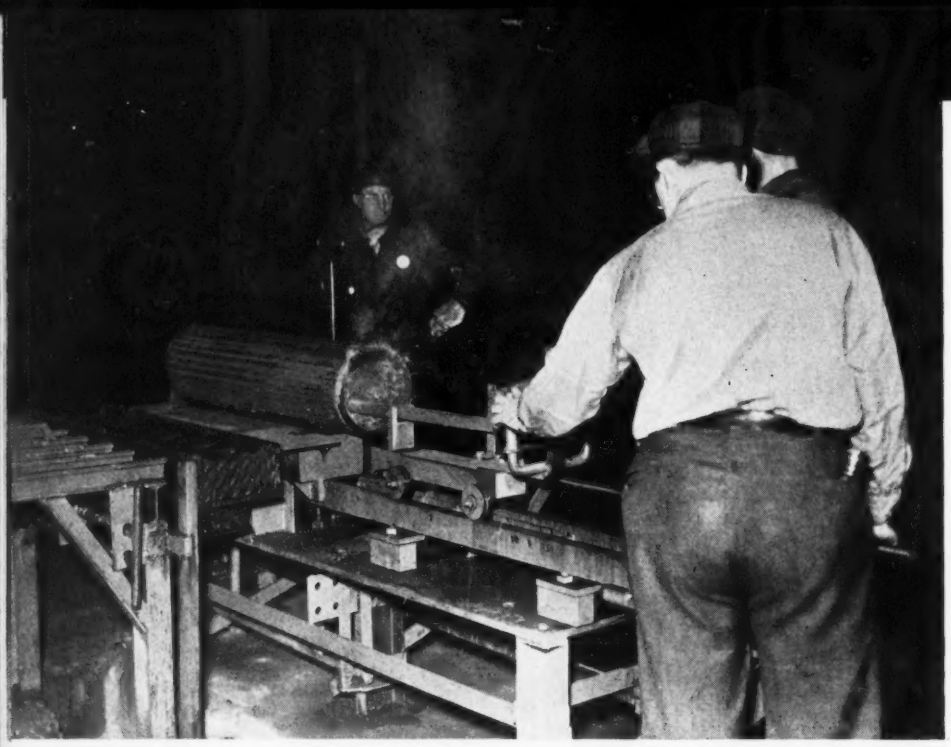


Fig. 9. Testing the Hot Shell for Concentricity. Inside Diameter of Shell is Held to Plus or Minus 0.0075 Inch

1/32 inch. The internal base surface of the shell is the reference point for facing the base and cutting off the open end. This internal surface of the base is held tightly against a locating mandrel, as shown in Fig. 11.

In the second machining operation, the shell is rough-turned with Stellite tools. As shown in the illustration, a slight hump is turned at the open end to provide the extra amount of steel needed to flow into place during the subsequent nose forging operation. The gaging points for this operation are the body diameter, the base end, the open end, and the shape of the profile.

In the third machining operation, shown in Fig. 10, the body of the shell is semi finish-turned and the band groove is rough-turned on a 36-inch by 13-foot Wickes engine lathe. Carbide tools are used, and a contour bar at the back of the lathe produces the desired shell profile, including the hump at the open end. For this operation, the gaging points are body diameter, base-end diameter, shape of profile, band-groove diameter, band-groove location, band-groove width, open-end diameter, diameter of hump, and diameter behind hump.

In the fourth machining operation, the boss is removed and the base end is checked for flatness. Here the machined shell forging is weighed for the first time, and must be within the limits specified.

The shell is then pushed along the roller conveyor to an oil-fired furnace for heating the open end preparatory to nosing. Here it is inserted open end first into one of several round

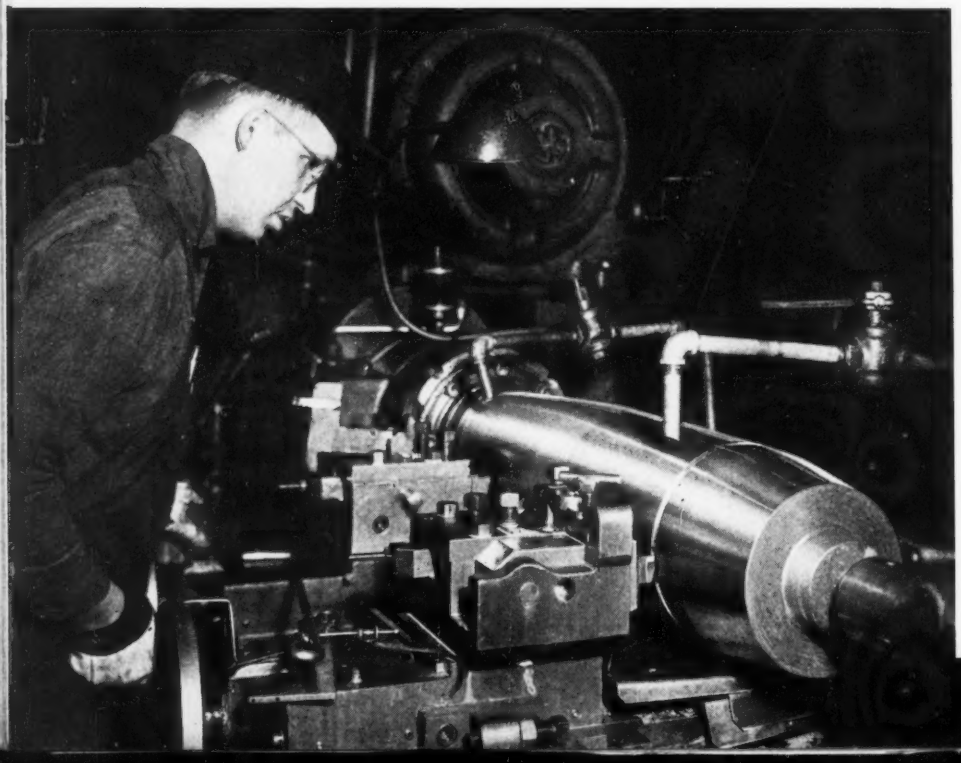


Fig. 10. Starting to Cut Band Groove after Shell has been Semi Finish-turned. In Semi Finish-turning, Correct Profile is Obtained by Using a Contour Guide at Rear of Lathe

openings in the furnace, and the open end is heated to the desired temperature. Eight to ten shells are heated in this furnace at one time, and the shells are rotated while heating. When removed, the shell is rolled along the front platform of the furnace, where it moves down a roller track and is turned on a rotating section to pass through an enclosed hydraulic descaler. It is then ready for the nosing operation.

The Bethlehem nosing press used for this operation has a capacity of 500 tons, and was one that had been used for car-building during peacetime operations. Extensions were provided to raise it so that the upright shell could be inserted beneath the ram. An air-cylinder actuated arm lifts the shell over the die pot and another air cylinder operates to hold the shell until it is correctly located under the die. It is dropped then, open end up, into the die pot, after which the die descends and forms the nose end of the

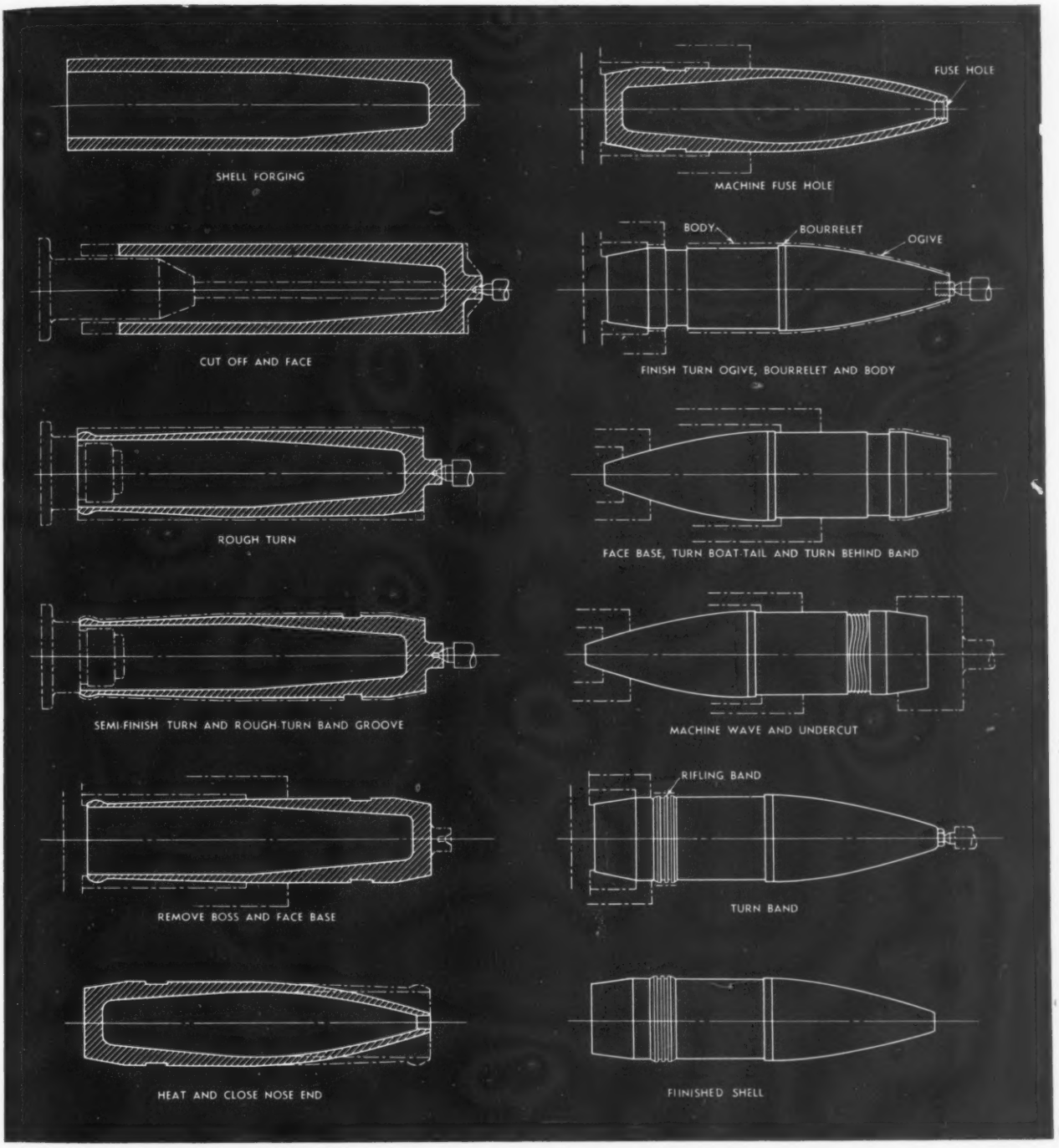


Fig. 11. Machining Operations on 240-millimeter Shell. Intermediate Operations Not Shown

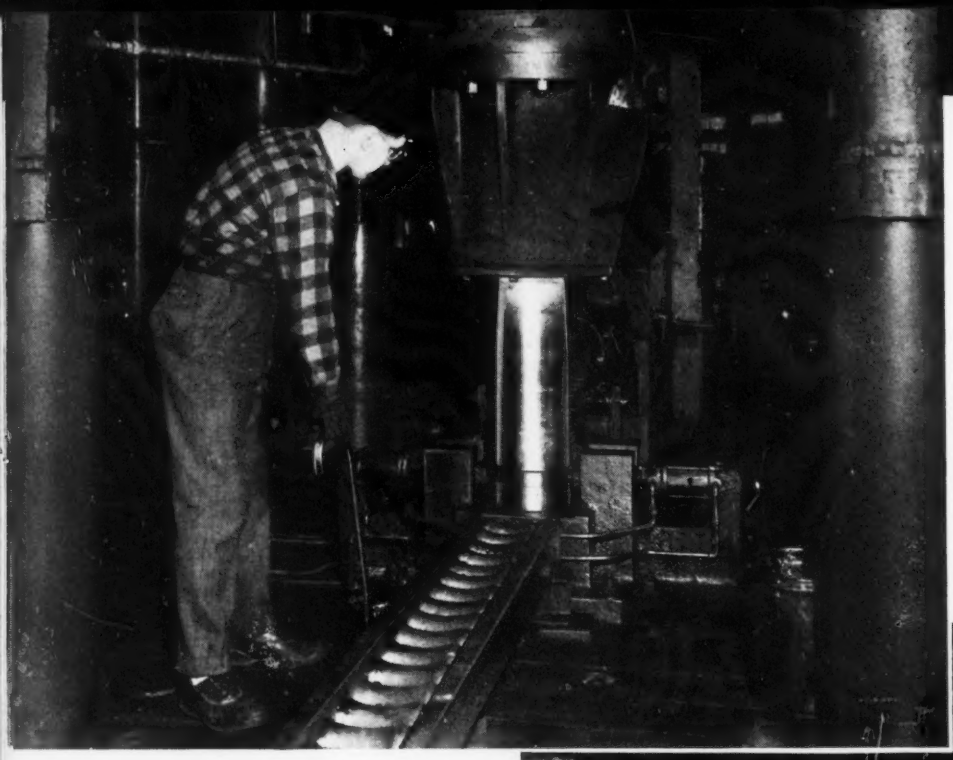


Fig. 12. (Left) Closing Shell Nose in a 500-ton Converted Car-building Press. Small Air Cylinders on Each Side Operate Stripper Plungers

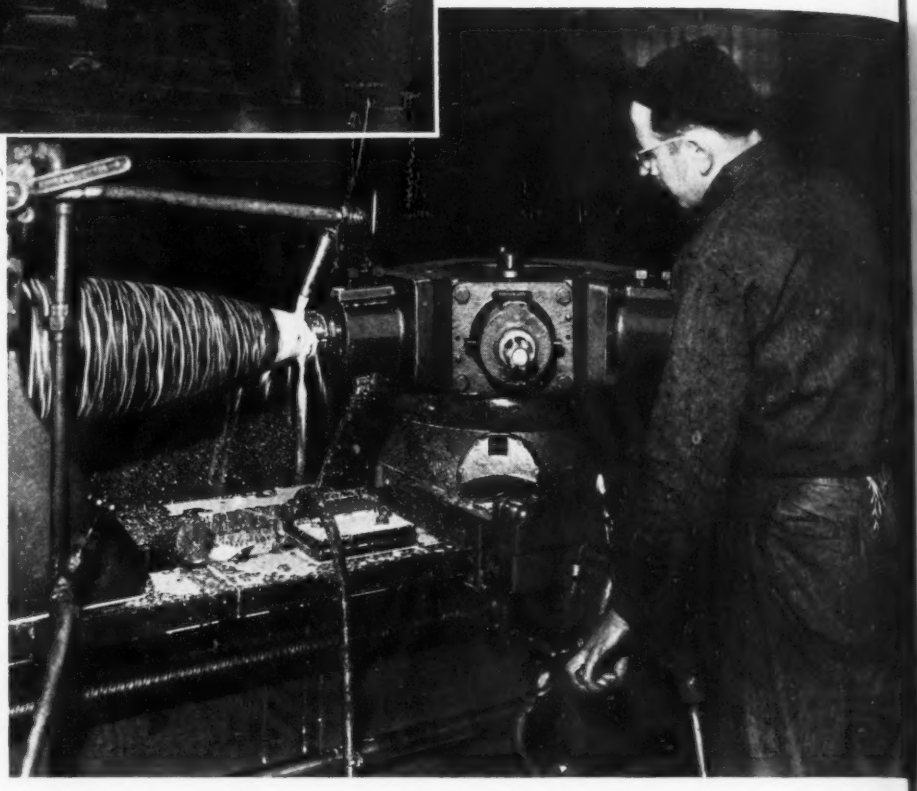


Fig. 13. (Right) Machining the Fuse Hole on a Six-position Turret Lathe. The Shell is Held by the Base End in a Three-jaw Hinged Collet Chuck

shell, as shown in Fig. 12. Two air-cylinder operated strippers that hold the shell as the nosing die is retracted can be seen in this illustration. A fifth air cylinder lifts the shell from the bottom of the die pot for unloading. It is pulled over by hand to an inclined conveyor, down which it slides, and is loaded, after careful inspection, on a hand truck, which carries it to a special floor area, where it is stacked upright on the base end for cooling.

After cooling, the shell goes to the heat-treating furnace. This is the largest equipment unit in the plant, and consists of a hardening furnace, a quench tank, and a draw-furnace, arranged for straight-line production, as shown in Fig. 14. In this illustration, a shell is seen being raised to the charging platform of the hardening furnace on a compressed-air lift. It is set directly on the furnace track rollers, which are made of alloy heat-resistant steel. Both hardening and drawing furnaces are of the pusher type, the controls being located on the center platform next to the quench tank. The entire heat-treating unit is operated by two men.

After a shell has been loaded on the tracks at the entrance of the hardening furnace, one of the workmen operates the controls. An air cylinder pushes the cold shell into the furnace, and as it does so, a fully heat-treated shell at the far end is pushed onto an inclined section of the track extending well inside the furnace, and slides down onto the center platform. In this way, shells remain in the correct temperature zone of the furnace until they are completely heat-

treated, and are then delivered quickly to the working platform. Here the shell is loaded nose down into a special articulated bail designed by the American Car and Foundry Co., and the loaded bail is dropped into the quench tank located under the working platform by a 500-pound Cleveland tramrail hoist.

Channels on each side guide the bail into place, so that the shell is held in the bath with its nose directly over a jet that circulates the oil inside while four agitators, at staggered positions around the tank, circulate the oil around the outside. The quench is maintained at the required temperature by being pumped through a Frick evaporator type water cooling tower located outdoors. The shell remains in the quench for the required time, and is then lifted out and loaded onto one of the tracks passing through the draw-furnace. An operator then actuates the controls, and the cooled shell is pushed into the draw-furnace. As the shell is pushed into the furnace, the operation ejects one from the discharge end.

During the hardening operation, the shells are given a good soaking heat, well above their critical temperature. The hardening furnace is direct-fired by two hand-operated and three automatically controlled burners firing from each side. The latter burners maintain a sufficiently high temperature in that area of the furnace in which the three farthest advanced shells are located to insure that after a shell is delivered to the central platform its temperature will remain above the critical point until it is fully quenched. No special atmosphere is used.

In the drawing operation, the temperature at which the shells are kept depends upon the carbon and manganese content of the particular heat of steel in process. Since the shells pass through this furnace grouped by the original steel mill heats, as previously mentioned, neither frequent nor large changes in temperature are required.

The draw-furnace is of the recirculating type, with burners firing in an upper chamber, so that only heated air comes in contact with the shells. There are two combustion chambers with a two-burner Mahr 2,000,000-B.T.U. external air heater in each. These are controlled for "on" and "off" operation, to maintain the proper temperature, by Leeds & Northrup recording controllers. The heated air is circulated by two high-temperature fans with alloy blades and water-cooled bearings that can operate at high temperatures.

After leaving the draw-furnace, the shells are carried on a power-operated conveyor to the Brinell station, where, when tested on a Tinius Olsen hardness testing machine, they must show the required hardness. The heat-treatment is designed to give the shell steel a minimum yield point of 60,000 pounds per square inch.

Fig. 14. Largest Unit in the Plant is the Heat-treating Equipment, Consisting of a Hardening Furnace, an Oil Quench Tank, and a Draw-furnace, Arranged for Straight-line Production

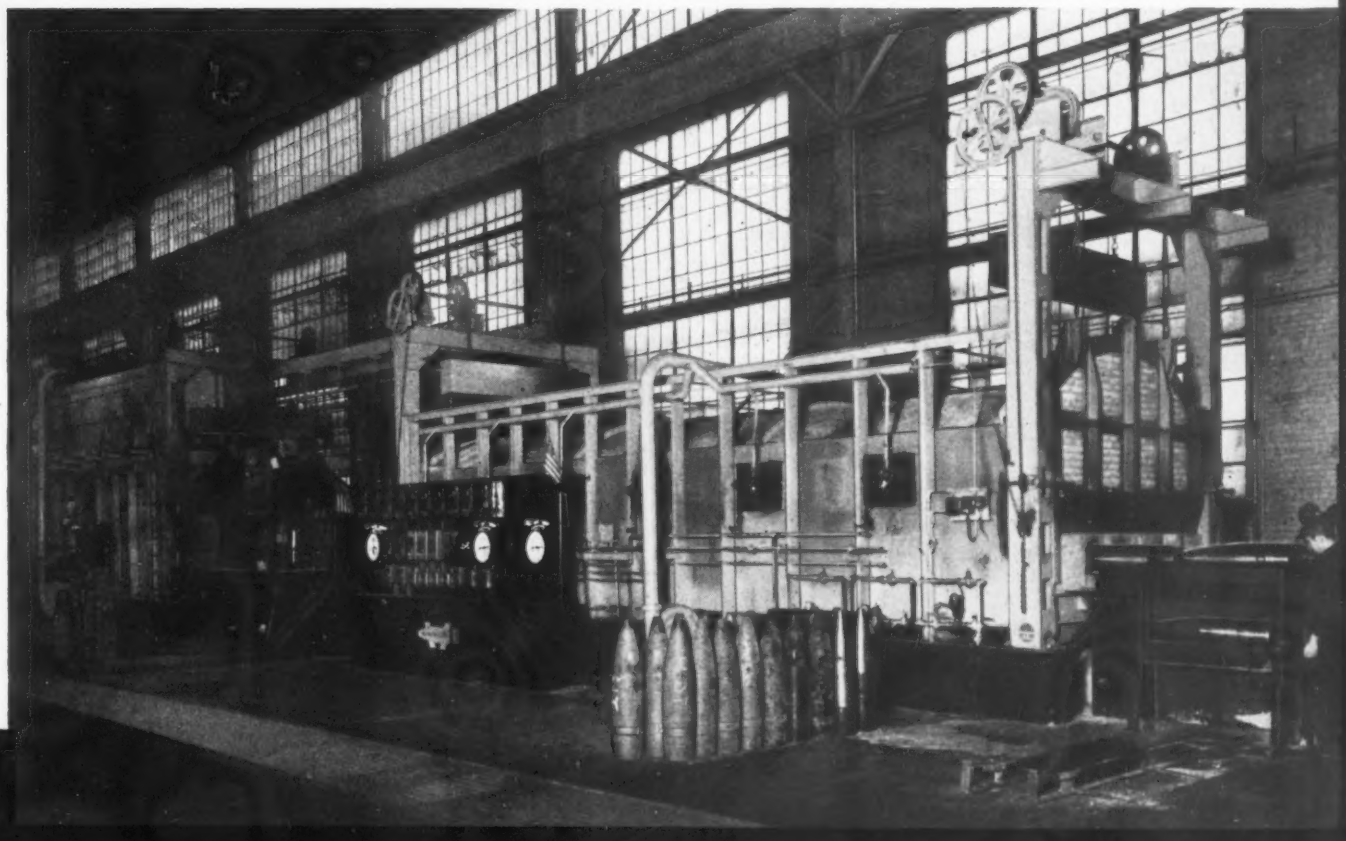


Fig. 15. (Left) Completing the Finish-turning Operation. Two Tools Take Simultaneous Cuts on the Ogive, Bourrelet, and Body of the Shell

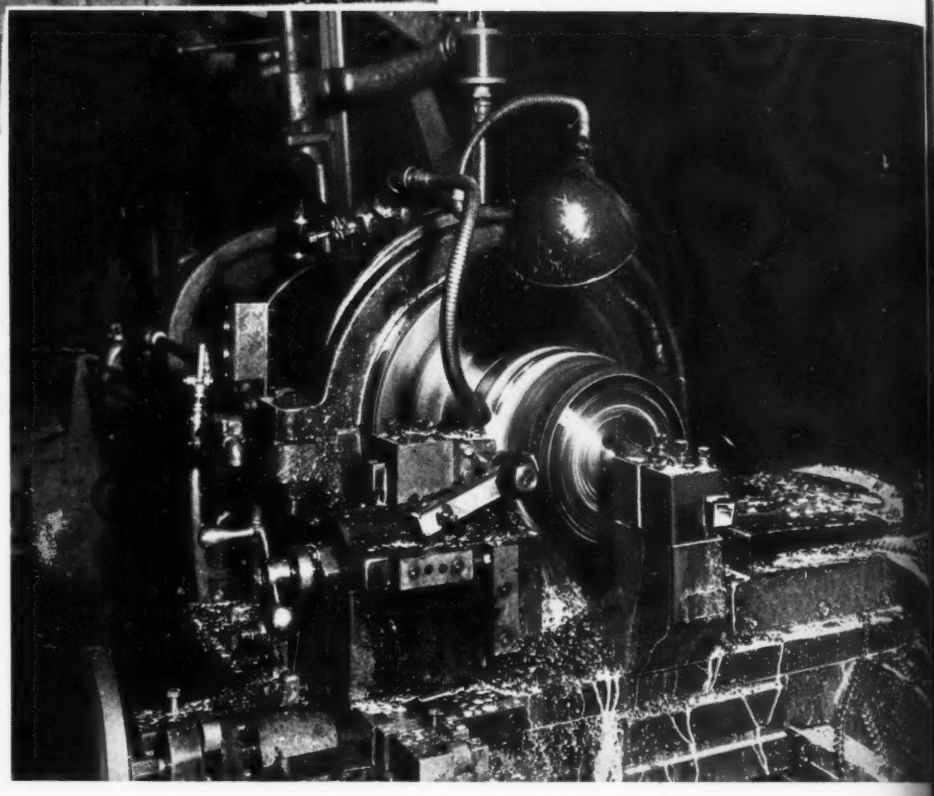


Fig. 16. (Right) Turning Boat-tail after the Base has been Faced. Shell is Held in a Pot Chuck Supported by a Center Bearing

The shells are then taken on hand trucks to a storage area, whence they can be rolled to a special machine for rough-facing and drilling the nose. This machine is located slightly below the floor level, so that the shells can be dropped into position. The machine is a rebuilt drilling machine that has been set over on its side and provided with a conveniently located large hand feed-wheel.

The shell is next placed on a lifting section of roller conveyor track and raised to pass through a series of additional machining operations. The first of these is the machining of the fuse hole on a 26-inch Libby turret lathe, as shown in Fig. 13. The shell is held by the base end in a three-jaw hinged collet chuck. At the first position of the turret, the fuse hole is rough- and finish-bored; at the second position, it is reamed; at the third position, it is finish-faced and countersunk; at the fourth and fifth positions, it is rough- and finish-tapped, respectively; and at the sixth position, a special tool is used to back-bore around the inside surface of the nose adjacent to the fuse hole. The gaging points for this operation are thread size and seating, bore diameter before threading, length of threaded portion and shoulder, diameter of 30-degree countersink, visual inspection of the thread and back-bore, and over-all length.

The next operation—finish-turning—is shown in Fig. 15 being performed on a Wickes 36-inch by 13-foot lathe. Two carbide tools take simultaneous cuts—one on the ogive or curved nose portion of the shell, and the other on the bour-

relet or bearing area which lies directly back of the ogive. The latter tool also turns the main body of the shell to a smaller diameter than the bourrelet.

Following this operation, the shell is again checked for weight and again must be within the specified limits. The shell now goes to a 26-inch by 10-foot Bridgeford lathe, where the boat-tail or taper at the base of the shell is finish-turned, as shown in Fig. 16. More than half of the shell is held inside a Logansport pot chuck, which is supported by the center bearing shown. That portion of the shell between the boat-tail and the band groove is also finish-turned and the base is finish-faced.

Two carbide tools are used, one for the facing operation and one for turning the boat-tail and the adjoining surface. The gaging points for this operation are the diameter, angle, and length of the boat-tail, the diameter and thickness of the base end, and the over-all length. The shell is checked a third time for weight after this operation.

In the next operation, five ridges are "wave-cut" around the bottom of the band slot, employing a single high-speed form cutter, as shown in Fig. 17. To obtain the "wave cut," the carriage is oscillated by cam action. Also mounted on the carriage is an under-cutting tool, which is swung into place to provide an under-cut at the rear end of the band groove. This under-cut provides for keying the band to the shell as it is squeezed down into the groove subsequently.

The nose end of the shell is held in a pot

Fig. 17. (Left) "Wave-cutting" Ridges in Bottom of Band Groove. The Shell Carriage is Oscillated by Cam Action

Fig. 18. (Right) Placing Band of Gilding Metal around Shell preparatory to Squeezing It into Place in a Six-cylinder Banding Press

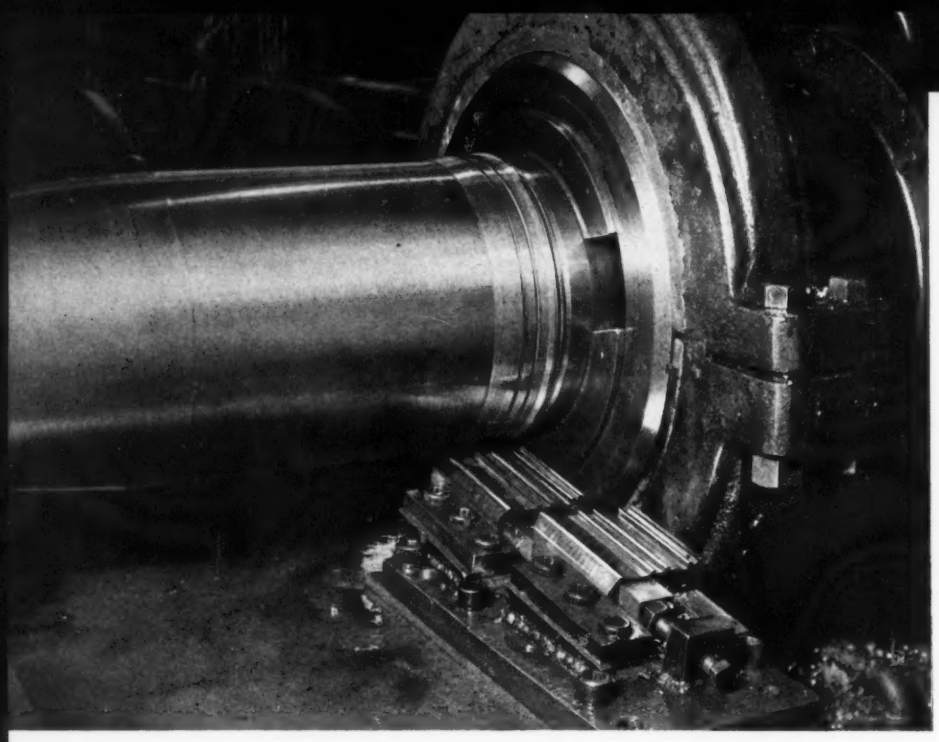


Fig. 19. Roughing and Finishing Form Cutters in Tandem Take Tangential Cuts in Rifling Band of Gilding Metal

chuck, and the base is supported by a centering cup, which rotates on a Timken tapered bearing. The gaging points for this operation are location and width of band groove, diameter and width of under-cut behind band, diameter of band groove, angle of under-cut, and depth of wave cut.

The shells next go to a washing machine, where they are set nose up on a platform which rotates them under a series of nozzles. The first nozzle provides compressed air to blow out any remaining scale, the second provides Oakite solution under pressure, the third and fourth provide rinse water, and at the final position, the shell is drained.

After washing, the shells are grouped together for a preliminary bench inspection. They are then ready for banding. The bands formerly used were copper, but gilding metal—a copper-zinc alloy—is now being used, because it has more desirable performance characteristics and has proved to be more easily machined. The bands are heated in a semi-muffle furnace.

As shown in Fig. 18, the shell is placed in a six-cylinder hydraulic banding press, and a heated band is dropped over the shell. This banding press operates directly from the shop hydraulic system at 1500 pounds per square inch line pressure. When the band is properly located over the banding groove, the press cylinders squeeze it tightly into place. To make sure that it is evenly seated, the band is given several squeezes and the shell is rotated slightly between each squeeze. From this point on, the

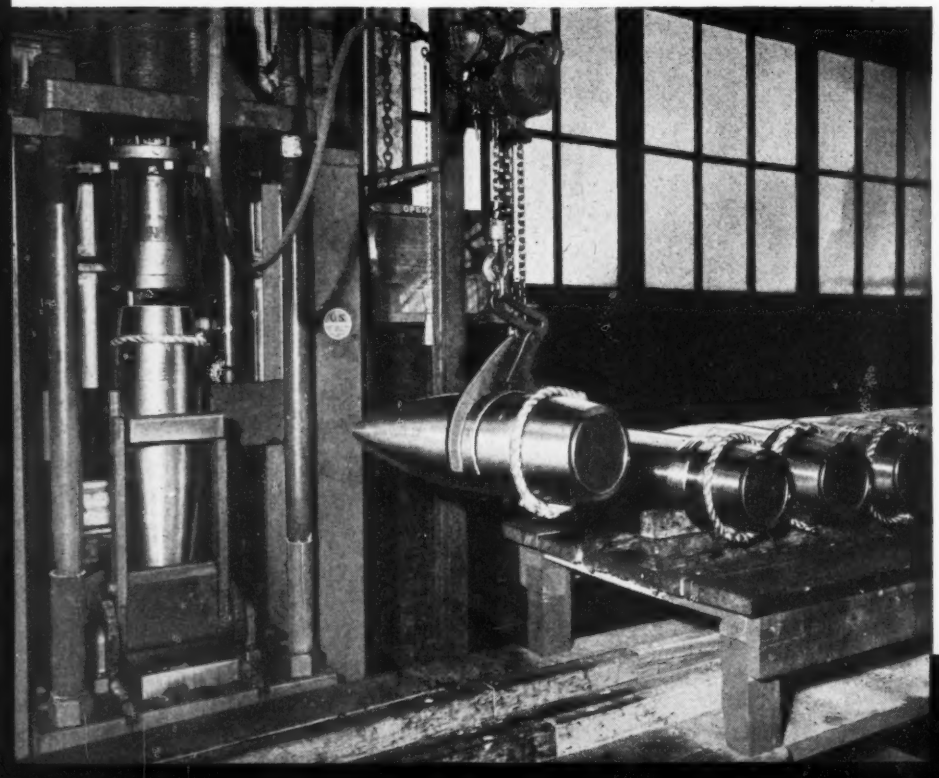


Fig. 20. A Shell in Press, Ready for the Base Cap to be Sealed by Having a Strip of Lead Pressed into Groove

Fig. 21. Shells being Cleaned of Any Scale Remaining in Cavity by Individual Blast Units, Using Chilled Steel Grit

shells are rolled along a wooden platform to prevent damage to the bourrelets.

The next operation is to turn the band. Fig. 19 shows this being accomplished on a 30-inch by 14-foot Putnam lathe. The band is first rough-turned to diameter, and then roughing and finishing form cutters, mounted in tandem on the cross-feed, take tangential cuts to form three grooves and a ridge in the band. The gaging points for this operation are diameter of band back of shoulder; diameter of band ahead of shoulder; diameter of cannelure; and over-all width, location, and profile of band.

Two additional tools are swivel-mounted on the front tool-holder for trimming each end of the band flush with the adjoining surfaces of the shell. A groove is also cut in the body of the shell next to one edge of the band to provide room for the band metal to expand when the rifling grooves are squeezed into it as the shell is propelled through the gun bore. After the gilding metal band is turned, the shell is checked a fourth time for weight and must again come within the range specified by American Car and Foundry.

The base is now grooved to receive the cover plate or base cover. Three cuts are taken—a straight cut and two under-cuts, one on each side—to form a dovetail groove. The gaging points are diameter and depth of base-cover groove, and width of groove at face and angle. When necessary on account of excess weight—and it is the purpose of the weigh station just mentioned to determine this—a facing cut is

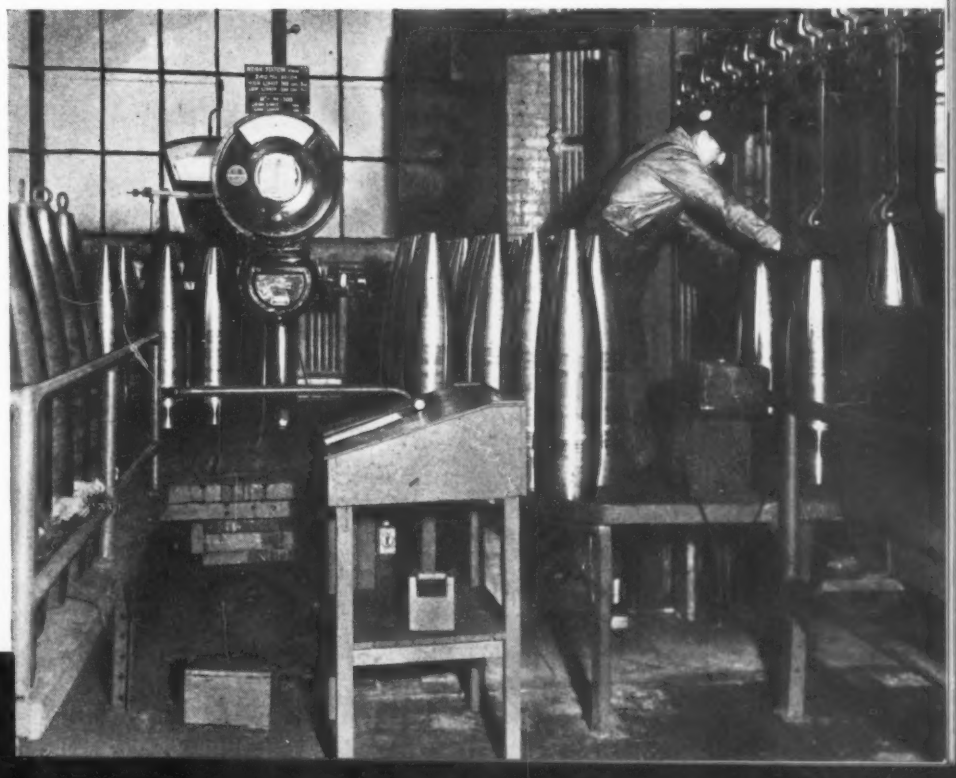


Fig. 22. Shells being Lifted off Carrying Conveyor Line preparatory to Final Weighing and Inspection

taken across the base of the shell to bring it within the required limits. The gaging points for the facing operation are flatness and thickness of base, diameter of boat-tail, and location of band from base.

Following this operation, a thin disk of mild steel, which has been formed into a shallow cap, is set into the groove in the base, and a strip of lead, about 3/8 inch wide and 3/32 inch thick, is inserted into the groove outside the edge of the cap. The shell is then lifted by a small Ingersoll air-operated hoist into a hydraulic lift, which raises it into place under the press for the seating operation, as shown in Fig. 20.

This operation forces the lead well down into the under-cut groove and holds the cap tightly in place. The reason for placing the cap on the end of the shell is to prevent gas from the firing charge entering through any small fissures that may have developed in the base due to the stresses caused by forging. This cap provides a gas-tight seal. Any excess lead is skived off with a knife after the shell is removed from the press. Two staking notches for the fuse are then cut near the end of the nose.

Following this, the shell goes to the individual shot-blast units shown in Fig. 21, where any scale in the interior formed during the nose forging operation is removed with No. 26 chilled steel grit. From the shot-blasting operation the shell goes to the degreasing tank, into which it is lowered, nose down, in a vertical position. Oakite, sprayed from both sides of the tank and also from the bottom through the nose of the shell, is used for cleaning. The warm degreasing liquid quickly evaporates after the shell is removed from the tank, and the shell then goes directly to the painting bench.

Fig. 23. (Left to Right) Nose Section of Shell Forging, Showing Remarkably Clean Cavity Walls; Cross-section of Billet; Banding Ring; and Cross-section of Banding Ring. In Foreground is a Piece Taken from Base of Shell, Showing Cap Sealed in Place with Flattened Lead Strip

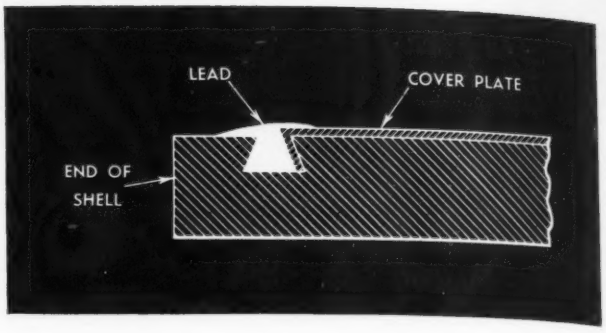


Fig. 24. Detail Showing Sealing of Cap on Base by Lead Compressed Tightly into Wedge-shaped Slot

Here a coat of black bituminous paint is applied by means of a compressed-air spray jet. The purpose of this paint is to separate the explosive charge and shell body, and thus assure that any slight shift of the charge will not be against abrasive surfaces. This paint also serves to prevent chemical action between the interior of the shell and the charge when the shell is stored for a considerable time before use. During this paint spraying operation, the shell is supported on rollers, which constantly rotate it.

The shell is then suspended on a hanger, which holds it by a plug screwed into the fuse hole, and is carried around a continuous overhead Link-Belt conveyor. A series of jets located around the conveyor causes a stream of cool air delivered from the outside by a 14-ounce pressure blower to be directed upward against the shell and into the cavity, and serves to bring its temperature down to a level suitable for final gaging.

In Fig. 22, shells are shown being removed from the conveyor at the final weighing station. Directly after weighing, the shell is subjected to a final company inspection involving thirty-six gaging operations. It then passes to the enclosed Government inspection area, and after passing this inspection is stamped with lot number, date, manufacturer's name, and type of shell. Lifting plugs are then screwed into the fuse hole and the band is masked.

Following the stamping operation, the shell goes to a spray booth to receive a coat of olive drab lacquer. After drying, the band mask is removed and a rope grommet is slipped over the shell to protect it from injury by impact with other shells. It is then ready to be shipped to the loading center.

Lockheed Practice in Stretching Aircraft Structural Parts

Stretch-Forming of Aluminum-Alloy Sheet Metal has Superseded Drop-Hammer and Deep-Drawing Operations on Many Lockheed Aircraft Skin Sections. Some Results of Stretch-Forming Tests and Typical Production Methods are Described in This Article

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THE forming of various aircraft skin sections from aluminum-alloy sheet by stretching has become an important operation at the plant of the Lockheed Aircraft Corporation. Parts of both shallow and deep curvature can be readily formed by stretching, and in many instances, the rate of output and cost per piece have shown a definite superiority as compared with methods formerly used.

In the case of certain skin sections having a so-called "shallow double curvature," or large radius of curvature in two planes, it was found that when aluminum-alloy sheet in the fully heat-treated condition was used, stretching provided the most practicable means of forming such sections. One of the reasons for this is that when the heat-treated aluminum alloy is formed to a slight curvature by an operation involving bending, the elasticity of the material tends to make it spring back, or resume its original shape, when the force applied to it is removed. As shown by diagram *A*, Fig. 1, when bending occurs, the fibers outside the neutral axis are placed in tension, while those inside the neutral axis are placed in com-

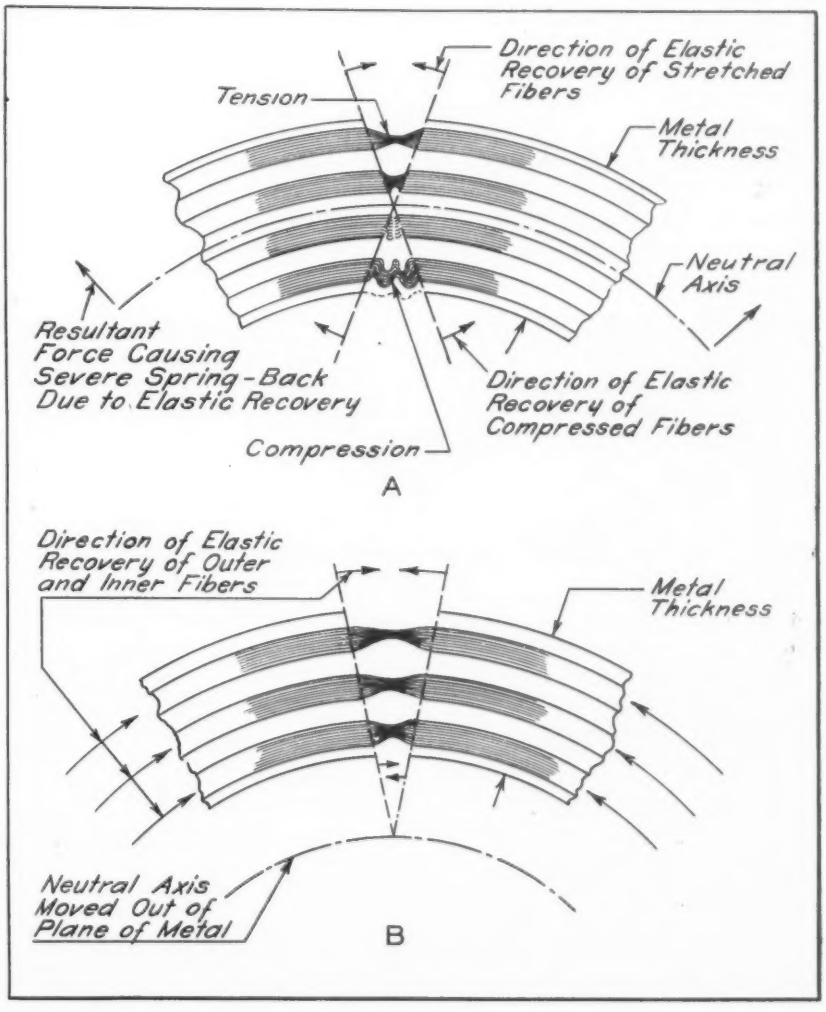

Direction of Elastic Recovery of Stretched Fibers
Tension
Metal Thickness
Neutral Axis
Resultant Force Causing Severe Spring-Back Due to Elastic Recovery
Direction of Elastic Recovery of Compressed Fibers
Compression
A
Direction of Elastic Recovery of Outer and Inner Fibers
Metal Thickness
Neutral Axis Moved Out of Plane of Metal
B

Fig. 1. The Effect of a Bending Operation on Sheet Metal is Shown by Diagram A. The Fibers Outside of the Neutral Axis are in Tension; Those Inside are in Compression. When the Bending Force is Released, These Stresses Tend to Make the Piece Spring Back and Assume its Original Shape. When the Material is Stretched, as Shown in Diagram B, all the Fibers are Placed in Tension beyond the Yield Point. Release of the Stretching Force may Cause the Piece to Compress or Shorten Slightly, but it will not Spring Back and Lose the Desired Curvature

Table 1. Temper Designation of Aluminum Alloys

Heat-Treatable Alloys			
Class	Description	Designation	Example
Wrought	Annealed condition	O	24S-O
	Fully heat-treated	T	24S-T
	Quenched, but not completely aged*	W	61S-W
	Heat-treated and cold-worked	RT	24S-RT
Cast	Specific heat-treatment indicated by number	T4 T6, etc.	195-T4 195-T6
Non-Heat-Treatable Alloys			
Class	Description	Designation	Example
Wrought	Annealed condition	O	3S-O
	Intermediate cold-worked	1/4H 1/2H 3/4H	52S-1/4H
	Maximum commercial degree of work-hardening	H	2S-H
Cast	No temper designation	....	43

*W temper applies only to alloys requiring artificial aging to attain T condition.

pression. When the forming pressure is released, both the tensile stresses in the outer fibers and the compression stresses in the inner fibers have a tendency to make the piece resume its original flat shape.

When the heat-treated aluminum alloy is stretched to a slight curvature, as shown by diagram *B*, Fig. 1, all the fibers are placed in tension, and are, in fact, pulled beyond the yield point of the material. The piece takes a set, and when the forming or pulling forces are released, the piece may tend to compress or shorten slightly along the direction of curvature, but it will not flatten out or spring back.

Simple stretching operations can be performed on a single-acting press equipped with a rubber punch and exerting pressures from 1200 to 2000 pounds per square inch, if the rubber is stacked in such a manner as to hold the material at the edges. Parts can readily be produced having lightening holes, joggles, beads, and flanges of concave, straight, or slightly convex curvature.

Parts having a shallow double curvature are formed most satisfactorily in a double-acting press. In this type of press a hold-down ram, moving independently of the punch ram, descends first, and by means of side clamps or rails, exerts a uniform holding pressure along opposite edges of the blank. The punch then descends and stretches the material. Usually there is no mating die, the forming being accomplished entirely by the punch, across which the blank is tightly drawn by the stretching action. In some cases, the sheet must be allowed to drape in be-

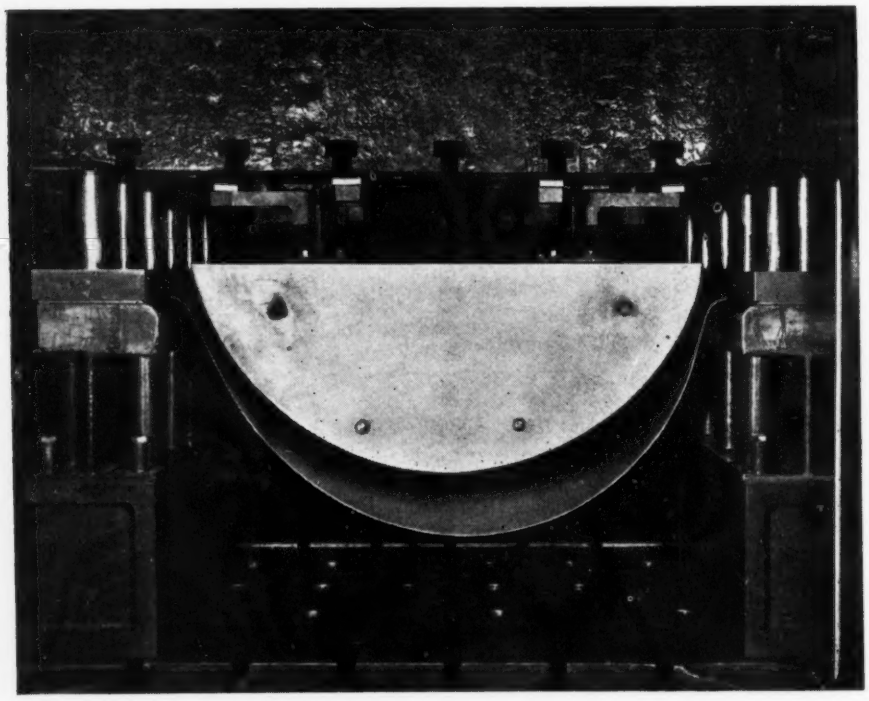


Fig. 2. Stretching a Piece of Aluminum-alloy Sheet Metal to Form Two Forward Skin Panels of Nacelles. Ends of Piece are Firmly Gripped by Two Side Rails

Table 2. Minimum Observed Physical Characteristics of Aluminum Alloys

All Tests Made on 0.032-inch Aluminum-alloy Sheet Materials

Aluminum-Alloy Material	Yield Strength, Pounds per Square Inch	Ultimate Strength, Pounds per Square Inch	Elongation				Edge Condition
			Per Cent in 2 Inches (Tensile Coupons)	Per Cent in 1/4 Inch (Tensile Coupons)	Per Cent in 42 to 48 Inches (Stretch Tests)	Min. Per Cent in 2 Inches† (Stretch Tests)	
53SW	22,900	33,700	19.0	29.0	10.8	10.4	Sheared
					16.8	17.0	Polished
53ST	33,000*	39,000*	14.0*				
61SW	24,300	38,100	19.5	30.1	8.2	7.5	Sheared
					17.6	14.1	Polished
61ST	39,000*	45,000*	12.0*				
52SO	13,976	29,412	21.5	37.0	13.1	12.3	Sheared
					16.5	15.5	Polished
52S-1/2H	29,680	38,461	11.0	19.7	3.1	3.1	Sheared
24SO Alc.	10,097	24,329	19.0	30.6	9.2	7.0	Sheared
					10.7	10.5	Polished
24ST Alc.	44,364	66,424	17.5	22.8	4.6	3.9	Sheared
					8.8	6.0	Polished

*Typical Values—Alcoa Handbook.

†These are lowest values observed on any 2-inch circle in any strip specimen tested, and do not include the point of fracture.

tween the rails before the punch descends, in order to prevent over-stretching.

The employment of the zinc-base alloy Kirksite "A" as a die material has been an important factor in making stretching an economical and feasible process for aircraft fabrication. Previous to the adoption of Kirksite "A," the high cost of tooling when dies of plain or alloy cast iron or cast steel were used, together with the length of time required to make dies of these materials, made it impractical to utilize deep-drawing or stretching operations for the relatively small quantities required in aircraft manufacture.

Kirksite can be sand-cast to shape, using patterns based on plaster "mock-ups" in which the necessary shrinkage allowances have been incorporated. The dies require little finish-machining as they come from the molds, except for surface grinding, and after use, the die material can be melted and used again. All these factors contribute to the economies which this material affords for use on relatively short production runs, as well as for mass production, as thousands of parts can be formed without recasting.

It may be well to point out here some of the essential differences between deep-drawing and stretching operations. Deep-drawing may be defined as the operation of forming sheet metal in such a way that it is forced to stretch considerably in one direction while being compressed in the other. The simplest example of such a process is the making of a cup from a

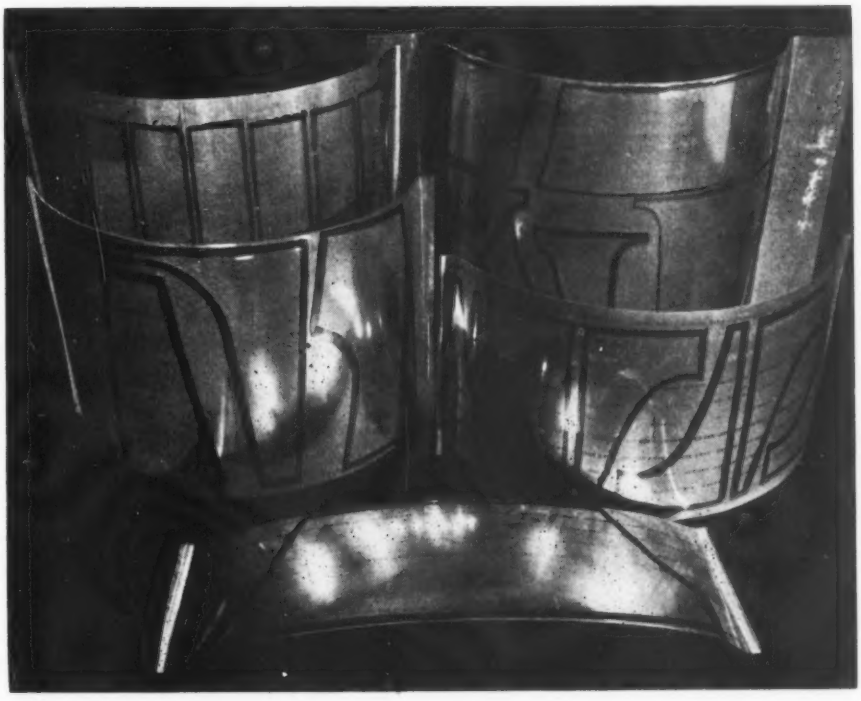


Fig. 3. Various Pieces of Alclad Sheet Formed by Stretching, Showing Way in which Several Parts are Nested together on One Sheet for Forming in a Single Operation

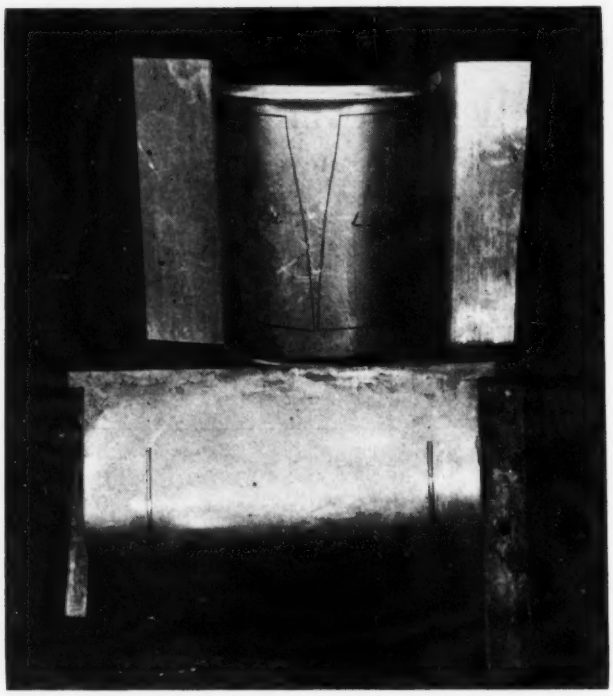


Fig. 4. Stretched Sheet with Two Fillets of Reverse Curvature, Shown with the Punch Used to Stretch Piece to Shape. Lateral Beading at Each End of Punch Locks Material in Place during Stretching Operation, and Prevents Wrinkling

circular flat blank. (Parts more complex than a simple cup may be regarded as being made up of straight sections plus portions of circular cups.) The material is forced to shrink in the circumferential direction as the diameter of the part changes from that corresponding to the original blank to that corresponding to the finished cup.

Deep-drawing is best accomplished on a double-acting press in which the material is forced to flow under a hard draw-ring while it is being shrunk from blank diameter to cup diameter. This draw-ring prevents buckling of the material under the compressive (shrinking) stresses, and prevents the wrinkling that occurs when deep-drawing is attempted on the drop-hammer.

In simple stretching, where a piece is formed to a compound curvature by stretching in only one direction, no compressive force is applied externally in the direction normal to that in which the material is being elongated. The only lateral deformation arises from the internal effect expressed by Poisson's ratio.

As a result, the limits of elongation of the material are found to be much less than in the case of drawing, where the compressive force applied externally seems to permit the material to elongate much more in the direction of stretching.

For simple stretching of 24S-O and 24S-T Alclad, it has been found at the Lockheed plant that elongations cannot safely be attempted in excess of the following amounts:

	Elongation in 2 Inches, Per Cent	Elongation in 1/4 Inch, Per Cent
24S-O	10-22	25-45
24S-T as purchased	12-21	25-35
24S-T heat-treated in plant	10-22	20-40

Permissible elongations for gage lengths of 42 to 48 inches are given in Table 2. It should be noted from the table above that the permissible percentage of elongation in 2 inches is about 50 per cent of the elongation in 1/4 inch.

If greater stretching must be achieved, some means of obtaining a drawing action, that is, a flow of material into the elongated area, must be found. Parts within the limits of forming by simple stretching need not be formed on a double-acting press if a stretching machine, such as an Erco machine, is available; but, as already pointed

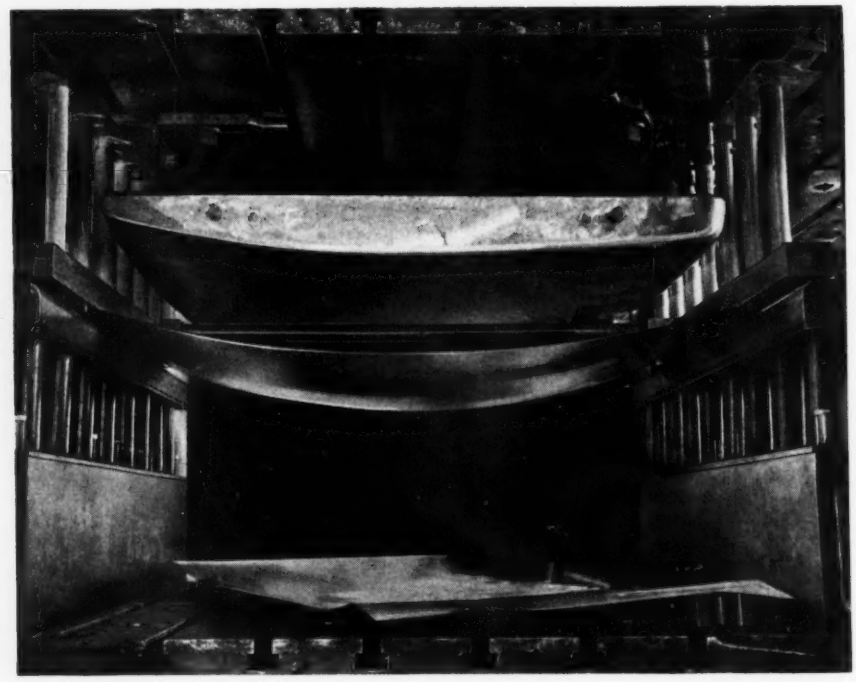


Fig. 5. Stretching a Piece to Very Shallow Curvature. Note Round Spacer Bar Extending between Upper Jaw of Each Side Clamp. Another Spacer Bar has been Removed from a Similar Position at the Front. These Prevent the Upper Holding Jaws from being Pulled toward Each Other as the Piece is Stretched

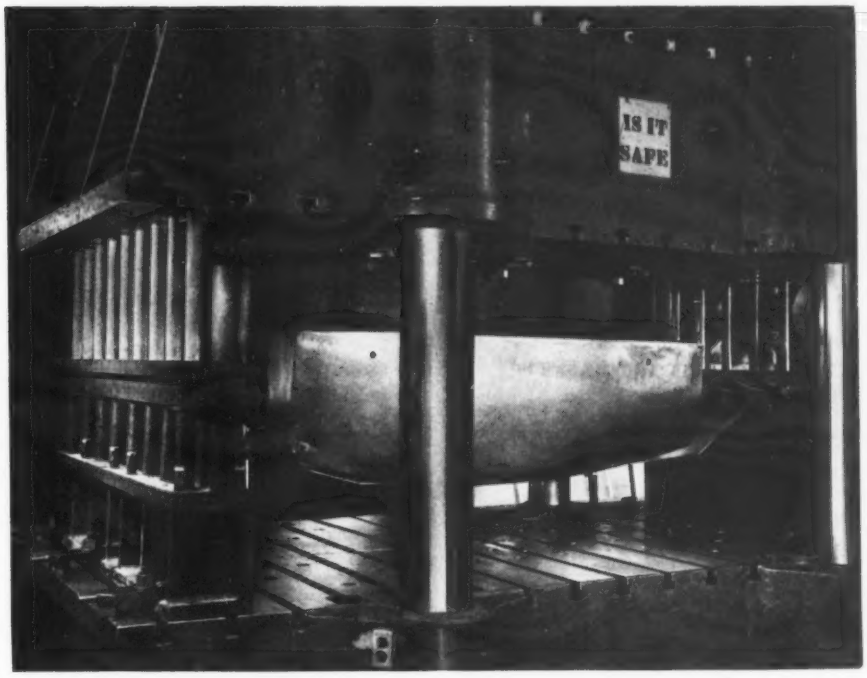


Fig. 6. Capstrips for Leading Edge of Stabilizer Nose Section being Stretched Longitudinally to a Double Curvature on a Hydraulic Press. Illustration Shows Beginning of Operation

out, parts having a large radius of curvature in two planes are most effectively formed in a press that provides independent hold-down action, to allow material to flow in under the draw-plate.

A series of tests was conducted at the Lockheed plant with the object of determining the suitability of a number of aluminum-alloy sheet materials with respect to forming operations. 53S-W, 61S-W, 52S-O, 52S-1/2H, 24S-O, and 24S-T materials (see Table 1 for the meaning of these designations) were tested to determine their behavior in a stretch-forming operation on a double-acting press. Some of the conclusions of this investigation indicate the extent to which these materials can be formed by this process.

Both the 53S-W and the 61S-W materials offer considerable promise for stretching operations in moderately stressed parts, such as cowling and fairing, which are difficult to form from the 24S-T sheet or which are distorted by heat-treating when formed from the 24S-O material.

The 52S-O alloy with sheared edges showed excellent stretch-forming characteristics, being considerably better than 24S-T Alclad, and better than 24S-O, 53S-W or 61S-W in respect to breakage caused by edge effect. For the polished-edge condition, its characteristics are about the same as 53S-W or 61S-W. Its main disadvantages appear to be that it has somewhat lower strength and a tendency to work-harden faster under drop-hammer or hydraulic press operations. 52S-½ H alloy is stronger, but has very poor stretch-forming characteristics.

It is of interest to note here that one of the results of these tests was the discovery of the importance of notch-free edges and uniform blank width in operations that cause high strain along the edges of the sheet. In a normal stretching operation, however, the edge condition is not so critical, because the maximum strains in production stretching usually occur at the transverse central portion of the blank.

To obtain higher strength, it was found that both the 53S-W and the 61S-W alloys can be artificially age-hardened by heating to 315 to 325 degrees F. for eighteen hours, or 345 to 355 degrees F. for eight hours. This aging treat-

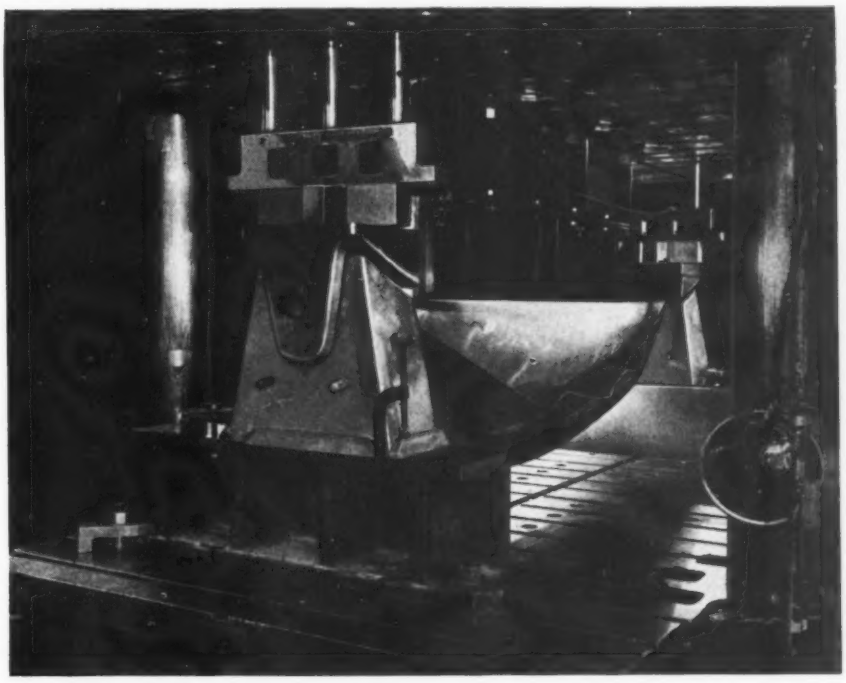


Fig. 7. Another Leading Edge or Capstrip Produced by Longitudinal Stretching. The Jaws at Each End which Hold the Sheet as it is Stretched are U-shaped

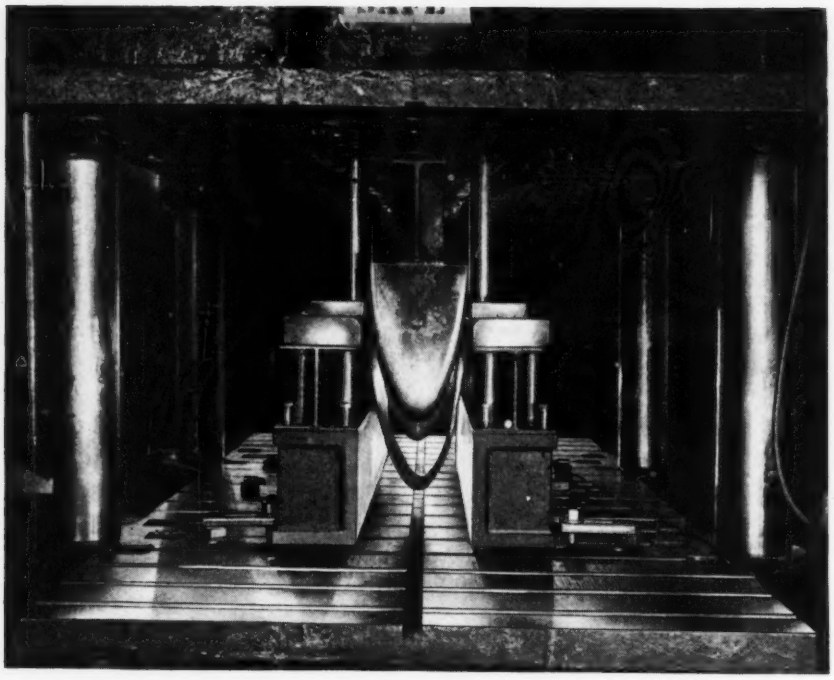


Fig. 8. Transverse Stretching of Double-curvature Nose and Side Sections in One Piece. Clamping Rails for This Operation Run Parallel to Punch instead of across Each End

ment can be done after forming, as the temperatures are sufficiently low so that no appreciable distortion occurs. The maximum strength obtained by this treatment is, however, considerably less than that of the 24S-T Alclad.

The 53S-W and the 61S-W materials were found to be capable of high local strain, and for short gage lengths of 2 inches are exceeded only by the 52S-O and the 24S-O Alclad materials in this respect. This characteristic is a definite advantage in many types of critical forming, such as small radius bends and dimples.

It was also evident that the 53S-W and the 61S-W materials age very slowly, and retain good elongation properties for a long period of time. Thus it did not appear from these tests that the degree of aging which took place during a six months' period would be sufficient to cause difficulty in forming.

A summary of the minimum physical properties and elongation values obtained during these tests is given in Table 2.

Some of the stretching operations by which various skin sections are formed at the Lockheed plant will now be described. The punch set shown in Fig. 2 was built to form the skin panels of the nacelles. Two rails are utilized to support and clamp the material, thus eliminating expensive mating dies. The sheet is stretched around the Kirksite punch, conforming perfectly to the contour. Because of the nearly constant curvature, it was found possible to form all the nacelle skins previously made on the drop-hammer with this one punch. Thus, the need for crown rolling to remove hammer marks, heat-treating, and another crown rolling to remove distortion resulting from the heat-treating operation was eliminated.

Maximum economy of material and production is achieved by combining operations, so that a number of parts can be blanked from one stretched sheet. The way in which parts can be "nested" for cutting from a single blank after stretching is shown in Fig. 3.

Fig. 4 shows the formed blank for two fillets of reverse curvature, which are formed from one piece of sheet aluminum alloy. The

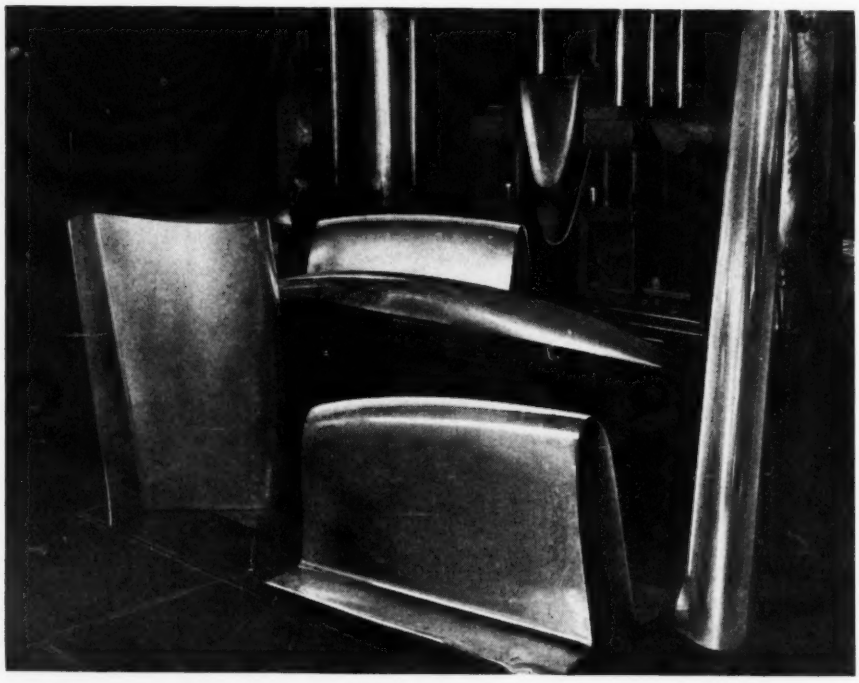


Fig. 9. Various Types of Parts Formed by Stretching. Material was First Stretched to its Limit of 7 to 9 Per Cent Elongation, Heat-treated, and Then Stretched Another 7 Per Cent. The Sheets are 0.020 and 0.025 Inch Thick

inward curvature along the length of each piece (not clearly seen) is the reverse of the outward lateral curvature. The punch that forms this piece is shown in the foreground. It will be noted that there is a beading at each end of the punch, which locks the material during the stretching operation and prevents it from "coning in" and wrinkling in the reverse curve area.

A piece of very shallow curvature is formed by the stretching punch shown in Fig. 5. This method is particularly suited to tempered material that cannot be formed by straight rubber pressing, unless formed in soft temper and then heat-treated, which introduces "coning" or warpage. In this operation, round spacer bars are inserted between the upper jaw of each side clamp to prevent these jaws from being pulled toward each other as the piece is stretched.

In Fig. 6 capstrips for the leading edge of a stabilizer nose section are being stretched longitudinally to a double curvature—that is, an outward curvature from end to end, and also a dished curvature. No die is used—only a single punch. In forming, the punch is brought down until the operator observes that the blank is completely stretched and hugs the punch without any wrinkles at the ends or sides. After being formed, the sheet is trimmed to the required length and width.

Another leading-edge or capstrip operation is shown in Fig. 7. Here U-type holders are employed in place of straight rails for gripping the ends of the sheet. Both upper and lower blank-holders have mating U-contours, and the sheet is curved by hand and placed between them at each end. These holders are brought together by the first action of the hold-down ram. The longitudinal stretching operation then takes place. This type of stretching is still in the experimental stage.

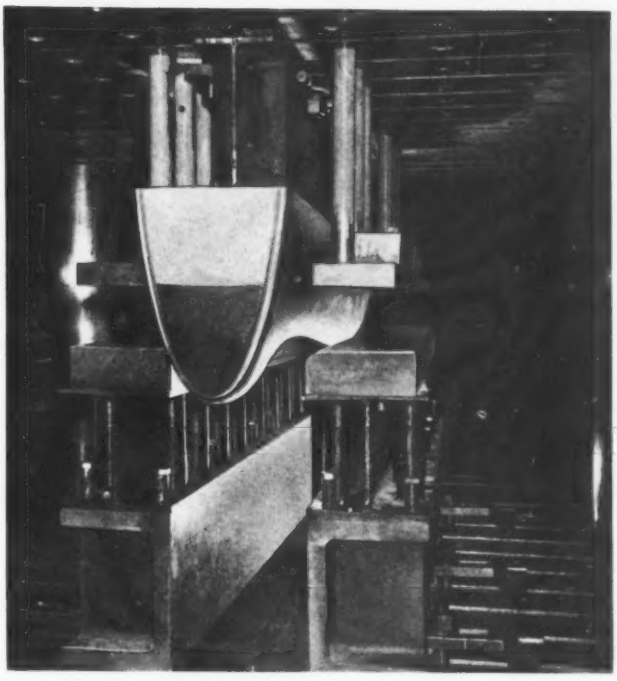


Fig. 10. Saddle-back Type of Punch Used to Form Section of Nose Stabilizer. The Clamping Jaws are Open, since Material is Not in Place

Fig. 11. Corrugated Pieces being Formed on 800-ton Double-action Hydraulic Press

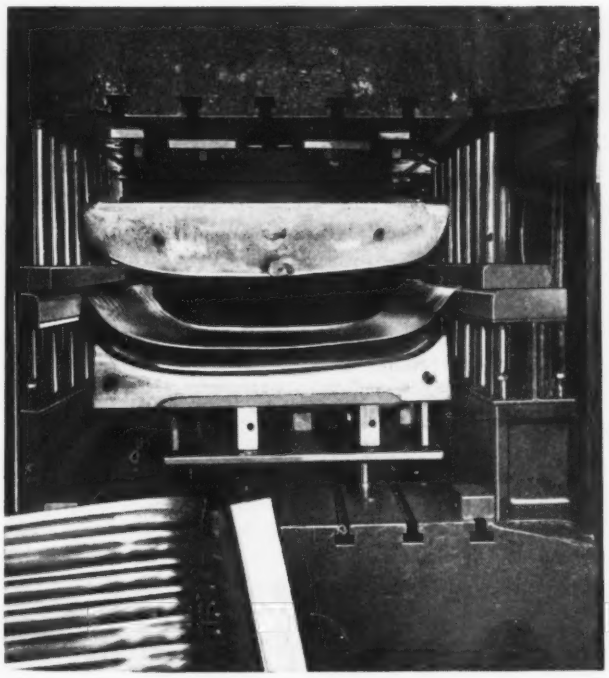
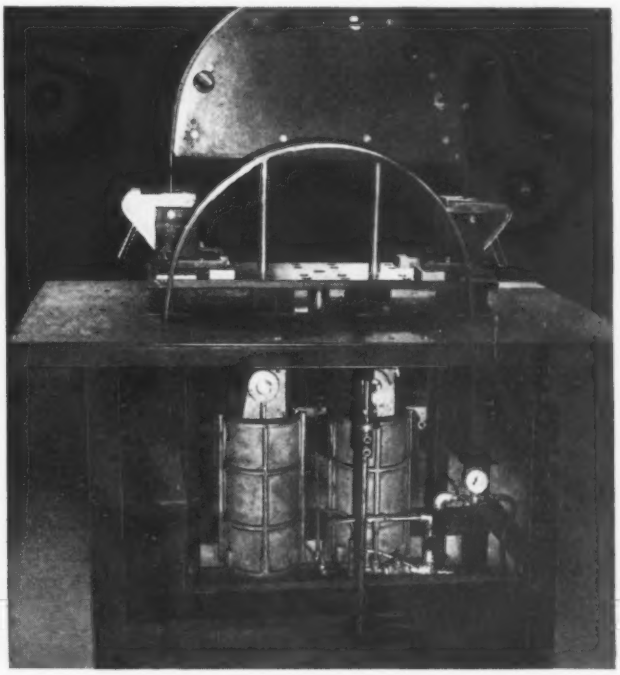
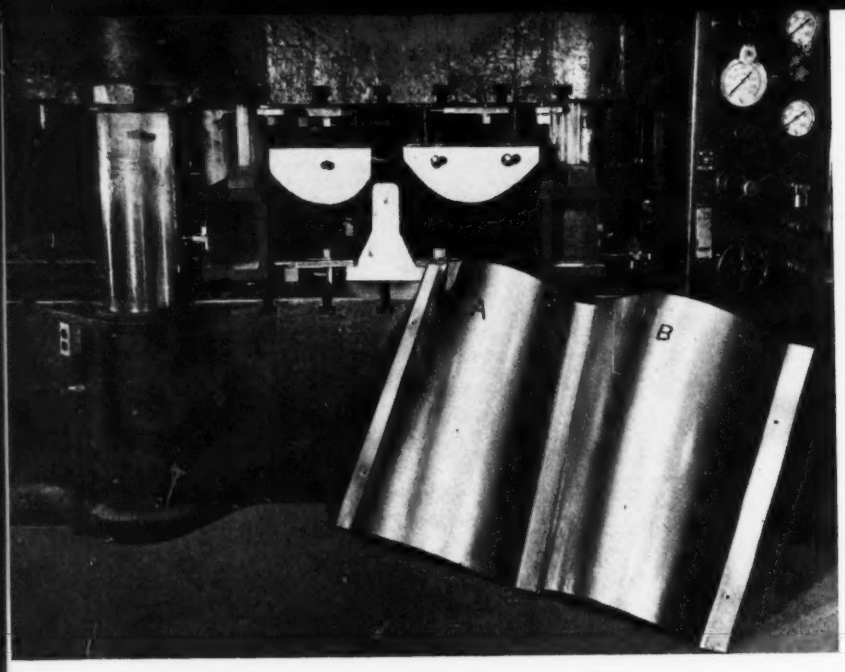
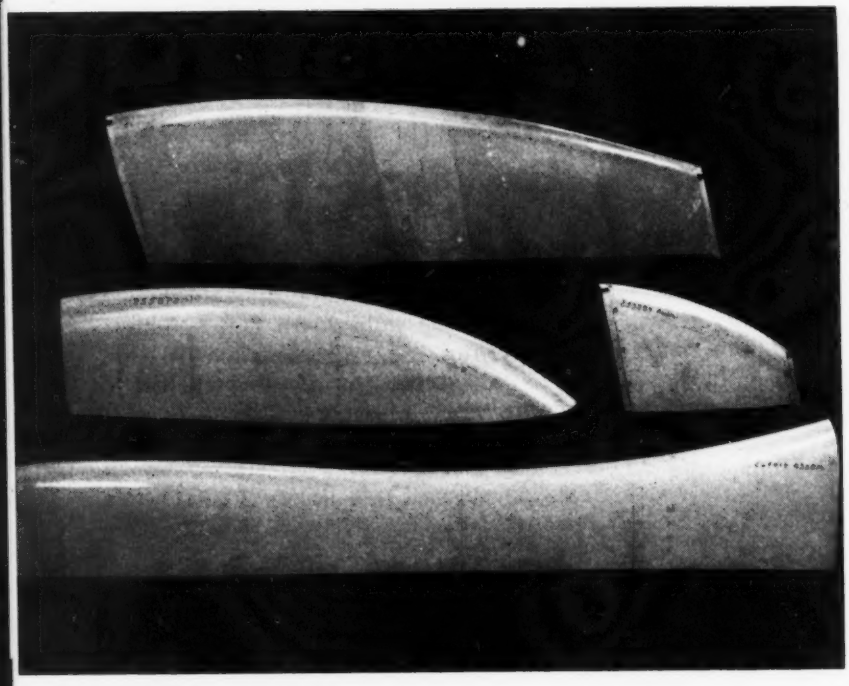
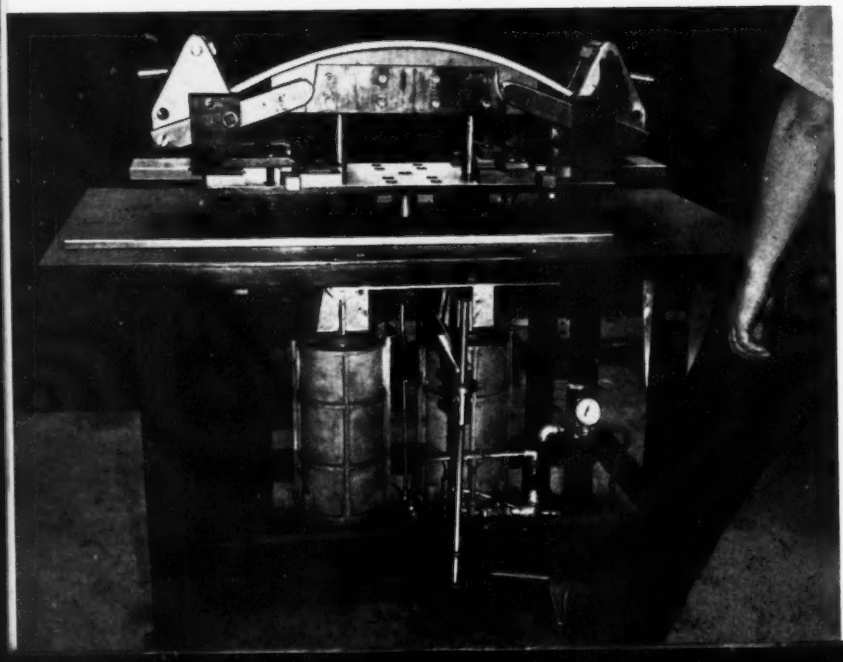


Fig. 12. Special Machine Designed to Stretch Short Pre-formed Lengths of Hat Sections









A transverse stretching operation in which the entire length of the piece is stretched within the limits of elongation is shown in Fig. 8. These are double-curvature stabilizer nose and side sections which are being formed in one piece.

Fig. 9 shows various types of parts produced by punches similar to those previously described. Forming was accomplished in two stages. In the first operation, the pieces were stretched to an elongation of 7 to 9 per cent. They were then heat-treated and a final stretch of an additional 7 per cent was given. This last operation removed all wrinkles and waviness resulting from the heat-treating.

In Fig. 13 are shown two parts *A* and *B* that have been stretched to shape as one piece in a single stroke of the press. If they were cut apart, and one piece turned end for end, the two parts would be seen to be exactly alike. This arrangement conserves material. If each piece were formed separately, the material would have to be cut at an angle, and additional flash would be required along the middle edges for clamping. Two regular clamps —one at each end—are used, and a dividing block is placed in the center to hold the metal up between the two parts.

The punch shown in Fig. 10 is similar to that shown in Fig. 8, except that the former is a reverse or saddle-back type. The piece produced by this punch is stretched in three sections, which are later spot-welded together. In the illustration, the material is not shown in place; hence the clamping jaws are apart.

Stretched pieces turned out on the punches here described are shown riveted together into complete units in Fig. 14.

An 800-ton double-action press equipped with a punch and die for turning out corrugated pieces is shown in Fig. 11. The metal sheet is put in place and clamped between the draw-plates, the lower of which is stationary and the upper attached to the upper ram.

Fig. 13. (Top) Two Parts Exactly Alike that are Stretched as One Piece. In Addition to Side Clamps, a Dividing Block is Used in the Middle to Lift Material up between the Two Parts

Fig. 14. (Center) Various Aircraft Parts Formed by Stretching, Shown Spot-welded together into Unit Sections

Fig. 15. (Bottom) Similar Machine to That Shown in Fig. 12, but Having a Different Clamping Arrangement which Places the Piece in Tension

PRACTICE

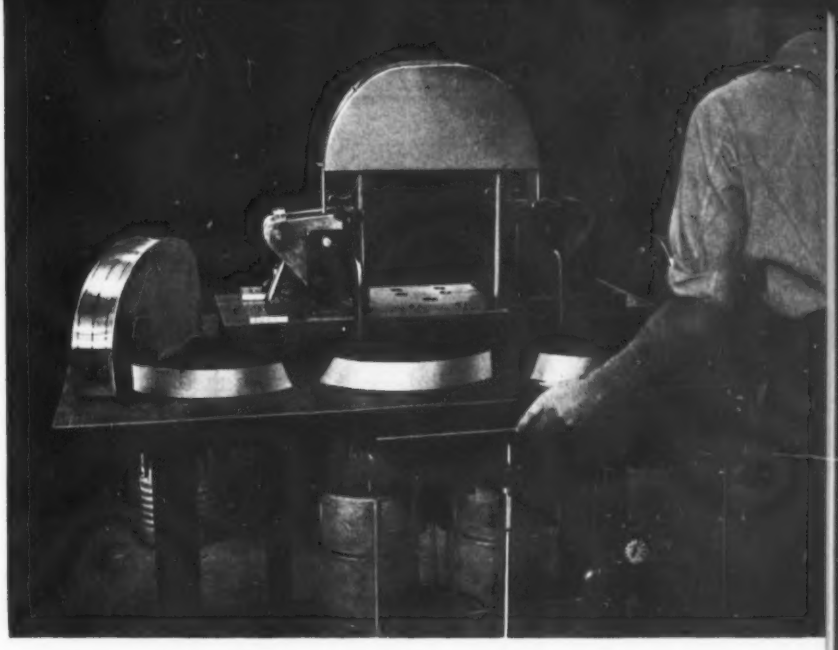
After the sheet has been clamped, the punch, which is attached to the main platen, is forced downward to form the general contour by stretching. The die, which is supported on rods actuated by air cushions underneath, is then raised, and the corrugations are formed to their full depth. The latter operation is accomplished in two stages.

In forming the corrugations, there is a biaxial stretch after the longitudinal stretch lengthwise to form the general contour. Thus in the first stretch the metal tends to bridge across the valleys of the punch. When the die comes up, the metal is pressed into these valleys, or lengthwise depressions, and the corrugations are thus formed. The piece is an inner frame for the nose section of a wing. Both punch and die are of Kirksite.

A specially developed machine for stretching short lengths of hat section is shown in Fig. 12. The pre-formed hat section is made of 24S aluminum, 0.064 inch thick, and is stretched immediately after heat-treatment in the W or quenched condition.

The section is bent by hand around the punch, so that the ends can be gripped in the self-energizing jaws. Air pressure is then applied to the cylinders below the table, the punch moves upward to stretch the material between 5 and 10 per cent, and all the longitudinal fibers of the hat section are placed in tension. While held in tension, a depression, or joggled portion, is beaten in with a hand mallet along two edges or flanges. One of these flattened sections is visible along the front edge of the piece toward the left-hand end. An upward lift of 15,000 pounds can be developed on this machine with a normal air pressure.

A similar machine with a slightly different clamping arrangement is shown in Fig. 15. This machine is used to form short lengths of hat section out of one-quarter hard temper stainless steel, 0.010



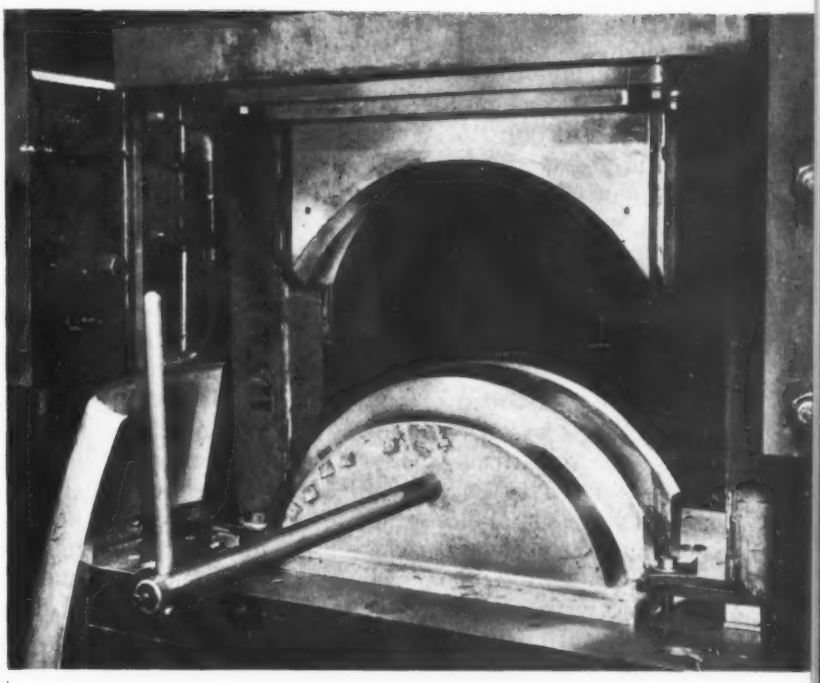


Fig. 16. (Top) Reverse-curvature Wing Fillet Doublers being Formed on Special Stretching Machine. These Pieces are Dished out Laterally, as well as Curved Outward along Their Length

Fig. 17. (Center) Curved Lip on Double Curved Piece of Cowling Formed by Wiping Action of Punch on a 125-ton Double-action Press

Fig. 18. (Bottom) Double-curvature Longitudinal Stretching Operation Performed on an 800-ton Hydraulic Press

inch thick. The clamps that hold each end of the piece are rotated outward to apply tension to the hat section before forming, in order to prevent wrinkling of the flanges while the punch forms the channel on the central portion of the piece.

The same machine is shown in Fig. 16 forming flat stock or sheets to a reverse-curvature wing fillet doubler. This piece is dished out laterally, as well as curved outward along its length.

Fig. 17 shows a 125-ton Clearing double-action press used to produce a curved lip on a double curved sheet. The vertical handle in the foreground serves to support the outer end of the work. The edge to be bent is placed on the curved form, or press bolster seat, which has a surface shaped like an inverted U. A pressure pad or ram comes down and holds the piece firmly while the back punch descends and "wipes" down the projecting edge of the sheet to produce the desired lip. The part is a piece of cowling.

Fig. 18 shows another double-curvature skin-stretching operation that is performed in regular production.

Savings Due to Using Pressed Metal in War Production

THE pressed metal industry has met the most exacting production demands during the present war. In the first World War, certain war materials were made from pressed metal, but the vast majority were made from forgings, castings, and bar stock, requiring a great many machining operations. It was to meet the tremendous demands of the present war that efforts were made to consider the redesigning of ordnance so that as much of it as practicable could be manufactured by the mass production methods possible in the stamping and pressed metal industries.

In May, 1942, a Suggestion and Conversion Section in the Office of the Chief of Ordnance and in the thirteen Ordnance Procurement Districts was organized. From that moment on, things started to happen quickly. Today, that Section has over 200 engineers, whose attention is being given to the redesigning of ordnance so that it can be made by mass production methods with substantial savings in scarce materials. In the first year of its operation, 2373 suggestions came in from ordnance engineers and from men in the pressed metal industry. Of these, 823 have been accepted and put into production.

Based on the ordnance requirements for 1943, this conversion program will effect substantial savings in critical materials. It is estimated that sufficient aluminum will be saved to build over 25,000 fighter planes; enough copper for 3,000,000,000 rounds of 0.50-caliber aircraft ammunition; and sufficient steel for the construction of 20,000 tanks. It is also estimated that 51,000,000 pounds of nickel, 5,200,000 pounds of molybdenum, 14,000;000 pounds of chromium, and 5,900,000 pounds of tin will be made available for manufacture of additional ordnance or other war material.

The instances of savings that have been effected by the redesigning of armament are too numerous to relate; but two cases may be mentioned to indicate how savings in metal and in man- and machine-hours have been effected by redesign and conversion to pressed-metal parts.

The body of 81-millimeter mortar shells is made from a rolled section and electrically flash-welded. This process is merely a variation of the automotive rear-axle housing method of fabrication. In making the shell, the rolled section is first blanked to shape, then one-half of the shell is formed, the top edges are restruck, the part is flash-welded, the outside flash is trimmed, inside flash trimmed, and the shell machine-finished. The redesigning process saves about 2 1/2 pounds of steel per shell, compared with the forging process, and fragmentation is improved due to the structure of the material.

Another case is that of the carbine trigger housing originally made from a forging, completely machined. This involved the use of elaborate milling, broaching, and profiling operations. Now these trigger housings are made from stamped parts that are assembled, spot-welded for location, hydrogen-welded, and finished. In the case of one order alone, this process released 97 milling machines, 16 broaching machines, and 21 profile-milling machines, and reduced the machining time by 720,000 machine-hours.

Small and large ordnance items and other war equipment are daily being redesigned for manufacture by pressed-metal fabrication. Aside from furnishing the United Nations with war equipment more quickly, the stamping method saves millions of man- and machine-hours, as well as thousands of tons of critical metals for use in producing ships, planes, and additional ordnance equipment. Furthermore, drop-forging, foundry, and machine shop equipment is available for the manufacture of other products that do not lend themselves to the manufacturing methods of the stamping industry.

Design of Stampings to Facilitate Production

By RALPH A. WAGNER, Chief Tool Designer
Consolidated Aircraft Corporation, San Diego, Calif.

Detailed Data on the Design of Stampings for Quantity Production, Types of Stampings Made, Materials Used, and Die Design Suggestions—First Article of a Series

THE broad group of products included under the comprehensive term "stampings" may be classified in various ways. One classification is in accordance with the operations performed—blanked, formed, drawn, or coined stampings.

Blanked parts are those which are merely cut to shape by "blanking" in a press and remain flat; they are referred to as blanks or flats. Holes are frequently punched or pierced in these blanks. Formed parts are shaped from blanks chiefly by bending, folding, or curling, with little or no flow of metal.

Drawn parts are those in which the metal is drawn or pulled over certain parts of the die or punch, the metal being stretched in so doing. Drawing, therefore, always involves more or less flow of metal and the finished drawn part does not usually have a uniform thickness. The metal is often, but not always, thinner at certain portions than the original metal thickness.

In coining, the metal of the blank is caused to flow as a result of pressure or impact. A coined stamping often has some sections thicker than the blank. Coined stampings are sometimes made from wire rod or bar stock, although, like nearly all other stampings, they are usually made from sheet or strip stock.

The term "pressed metal part" is sometimes used instead of the word "stamping." The latter, however, is more generally used in this country, while in England the term "pressing" is used more often than "stamping."

Stampings are generally made in power presses or punch presses, but some blanks can be made in shears and some formed parts in brakes. As a rule, neither shears nor brakes require dies other than such as are kept in stock with the machines; but since presses are generally used, stampings are commonly made in dies, which, as a rule, are designed for each part.

Classification of Stampings

Stampings may be grouped under the following nine classifications: (1) Flats; (2) bends, folds, brakes, curls, and U's; (3) small round, oblong, or irregular stampings; (4) small cupped stampings; (5) small and medium-sized straps, handles, brackets, hinges, etc.; (6) medium-heavy; (7) heavy; (8) heavy, hot; and (9) deep-drawn.

Flats—These are stampings, the faces of which are not bent or formed; the edges may be straight or curved, and the stampings may or may not have holes. Some flats are referred to as blanks, especially when other operations are to be performed on them; but often they constitute the finished piece. This classification includes such articles as washers, links, bottle openers, disks, quadrants, laminations, brackets, and numerous small machine parts like those for typewriters and adding machines.

Bends, Folds, Brakes, Curls, and U's—This class of stampings has one or more bends at any required angle. Included in this classification are parts having folds, corrugations, or flanges, which, in turn, may be notched, curved, tapered, or plain, with or without holes. Such stampings are commonly made from stock up to 3/16 inch thick, or even thicker, and are often made from stock in long lengths. They are frequently referred to as "brake work," since they are, as a rule, made on brakes.

Small Round, Oblong, or Irregular Stampings—This group includes a great many miscellaneous stampings, with or without embossing depressions, notches, perforations, or flanges. The stock used ranges from very light up to 3/32 inch thick. In size, these stampings vary from very small up to about 4 by 4 inches. Parts in this class include shade-holders, latches, small housings, and the like.

Small Cupped Stampings—Cylindrical, round, and other cupped stampings are included in this group. Sometimes the bottom portion may be removed or stepped, or form a neck. All of these are drawn parts, since they have undergone operations in which the metal is stretched or drawn. The sizes range from about 1/2 inch in diameter up to about 4 inches. These stampings are used for such parts as refrigerator skids, spring cups, caps and screw tops for containers, hinged covers, and small motor end plates.

Small and Medium-Sized Straps, Handles, Brackets, Hinges, etc.—The parts under this classification may be notched, lanced, bent, formed, or curled. Stock from 1/16 to 3/16 inch thick is commonly used, and the sizes run from 4 to 12 inches long by 1 to 12 inches wide.

Medium-Heavy Stampings—Under this heading are included cold-formed or drawn parts usually of mild steel in such shapes as cups, flanged drums, brackets, and the like, in round and irregular shapes. The cups may run in size from 3 to 10 inches in diameter, made from stock about 3/32 to 5/16 inch thick. Brackets and other parts in this class are made from about 1/16 to 1/4 inch thick stock, from 8 to 16 inches long, and from 2 to 4 inches wide.

Heavy Stampings—Cold-formed and drawn parts made from material—usually steel—1/8 to 5/16 inch thick, and ranging in sizes and shapes larger than those mentioned in the preceding paragraph, form the class known as heavy stampings. They include automobile-frame side rails, frame parts involving difficult curves and contours, deep-drawn laundry tubs, large brake-drums, axle housings, heavy channels, certain tractor parts, and parts with louvers or heavy embossing.

Heavy Hot Stampings—Parts formed or drawn hot from high- or low-carbon steel from 3/16 to 7/16 inch thick constitute this class. They include such parts as end flanges, insulator caps, pipe trunnions, handles bent from pipe, tractor lugs and wheels, corrugated plates, heavy straps, braces, and brackets.

Deep-Drawn Stampings—These stampings range from small cartridge shells up to large washing machine and laundry tubs; cowls for airplanes; refrigerator inner and outer doors, side and lower panels; oils-pans; tote boxes; automobile fenders, door panels, hoods, wheel parts, one-piece turret tops, and the like.

Materials Used for Stampings

Low-carbon steel is employed for more stampings than any other metal because of its low cost, excellent working characteristics, and high physical properties. A great number of stampings are also made from non-ferrous metals, especially brass and aluminum. Other materials used include bronze, copper, zinc, nickel alloys, magnesium alloys, silver, and gold.

Among the ferrous materials used, there are several kinds of steel, such as hot- and cold-rolled steel, tin plate, and stainless steel.

Hot- and Cold-Rolled Steel

Hot-rolled steel strips are produced in thicknesses from No. 23 to No. 7 gage. Plates are rolled in thicknesses from 3/16 inch up to 2 inches, but stampings are rarely made from material thicker than 1/2 inch. Stampings used in unexposed places or as parts of some design where fine finish is not essential are usually made from hot-rolled steel. Typical stampings are those used for switch boxes, automobile-frame parts, and tractor parts. Obviously, these parts can be produced from any one of several different materials, but the purpose of a part naturally determines to a great extent the type of material to be used.

Cold-rolled light steel sheets are made in gages from 30 to 17, and heavy sheets are rolled from 16 to 7 gage. Cold-rolled sheets are superior in finish to hot-rolled sheets. The cost is usually higher, but cold-rolled sheets are used when a superior finish is wanted and warrants the higher price. Most stampings for exposed parts used in homes, offices, and for such products as refrigerators, metal furniture, and the like, are produced from cold-rolled stock. When parts such as washing machine tubs, refrigerator inner shells, and range parts that are to be porcelain-enameled are being made, "enameled iron" sheets are specified. This is a special type of cold-rolled steel. There are, of course, many grades and several different analyses of cold-rolled steel. Certain grades are specially adapted for deep-drawing.

Tin Plate for Stampings

Tin plate is a good grade of steel, from 38 to 15 gage, coated with tin by hot-dipping, or more recently, by an electrolytic process. It is used for such products as tin cans and containers, inexpensive toys, novelties, and a variety of other parts that are often seamed and soldered in assembly. The tin coating is very thin, but provides a bright finish, high in corrosion resistance and easily soldered.

Stainless-Steel Stampings

Stainless-steel sheets are rolled from 0.005 inch thick up to No. 8 gage; plates are rolled from 3/16 inch thick up to 1 inch. Several analyses are available in both hot- and cold-rolled material. Many such sheets are furnished polished, the polishing being done after the rolling. This is an expensive and high-grade material. At first, stainless steel was used chiefly for cutlery, but it is now drawn and formed into stampings for household duty and utility (except for present war emergency restrictions). It is also used for flat-irons, toasters, lamp bases, cooking utensils, trays, food containers, and similar purposes. Its primary value is its high corrosion resistance. It also takes a lasting polish and presents a pleasing appearance. Stainless-steel stampings are gaining in use in

the aircraft industry because of their strength and also because of being available in very light gages.

Several other materials containing large percentages of nickel, such as nickel silver and Monel metal, are sometimes used for stamping products similar to those stamped from stainless steel, because these alloys, too, are high in corrosion resistance.

Copper for Stampings

Copper is rolled into sheets and strips for fabricating into formed and drawn products, especially those requiring high corrosion resistance, great ductility, or high electrical or heat conductivity. It is available in either hard or soft grades. Copper and copper-base alloys can be had in thicknesses ranging from 0.0162 up to 0.250 inch. Copper is produced in rolls (strips) or sheets and is often tinned on one side. It does not tarnish rapidly in dry air, but corrodes in moist air, forming a poisonous compound. Stampings produced from copper include parts for electrical equipment, kitchen utensils, wash tubs, and radiator and condenser parts. Frequently, copper stampings are assembled by being folded or seamed together, or soldered where leakproof containers are essential, although, of course, deep-drawn seamless parts are readily produced.

Bronze, Brass, and Zinc Stampings

Bronze is used for formed and drawn parts, chiefly for those which require high corrosion resistance, or in which a bronze color is wanted for ornamental purposes. Many beautiful novelties, lamp parts, artistic hardware, springs, etc., are among the parts for which bronze is effectively used.

Brass is high in corrosion resistance and is more adaptable to deep-drawing than bronze. It is available in sheets, strips, and coils for forming, drawing, and metal spinning. The thickness of the sheets varies from 0.005 to 0.064 inch in soft brass, and from 0.0126 to 0.750 inch in the "half-hard" material.

More types of stamped products are made from brass than from any other non-ferrous material. Among parts so made may be mentioned cartridge shells, fuse caps, many types of hardware, gaskets, parts for electrical equipment, nameplates, eyelets, tanks, trays, radiator parts, reflectors, lamp parts and fixtures, clock and watch parts, evaporator parts, musical instrument parts, and the like. Parts made from brass are often polished, lacquered, enameled, or plated, and can be joined by practically all methods used for other metals.

Zinc used for forming and drawing is available chiefly in strips. It is obtainable in thicknesses ranging from 0.004 to 0.250 inch. It takes a high polish, but tarnishes easily, although its corrosion resistance in dry atmosphere is good. In the presence of moisture, it is subject to "white rust." Among the stampings produced from rolled zinc may be mentioned can tops and cells for dry batteries, weather stripping, embossed plates, moldings, and similar parts.

Zinc is a relatively soft metal and quite ductile; hence, it is easily worked. It can be plated, lacquered, enameled, or chemically colored. It is also easily soldered. In ordering zinc sheets for stamping, it is advisable to send a sketch or drawing of the product to be made to the mill to insure the right grade of zinc for the job.

Aluminum Stampings

Aluminum has approximately the same hardness as zinc. It is a good conductor of heat and electricity, and resists corrosion effectively in dry air; though white oxides form in moist or salt air. Aluminum sheets are available in many alloys, some of which can be heat-treated. Aluminum is rolled in sheets and strips from 0.0063 to 1/2 inch in thickness, and is also made in very light foils.

Aluminum and aluminum-alloy stampings are used extensively in the construction of aircraft, railroad cars, bus and truck bodies, kitchen utensils, cups, thimbles, etc. These parts can be either formed or drawn in one piece, since aluminum is extremely ductile; or welding, brazing, and riveting may be used as assembly methods.

Strength and Ductility of Materials Used for Stampings

When in service, some stampings are subjected to heavy stresses and the design must take into consideration what these stresses are likely to be. The intensity of the stress and the manner in which it is applied determine the gage and often the type of material used. In the manufacture of stressed parts, both the strength and the working properties of the stock from which the parts are to be made must be considered; but in parts which carry little or no stress, the working qualities of the metal are the primary consideration. The more ductile the material, the easier it can be worked. It is essential to select ductile material when it will be subjected to much working in the forming process, as in deep-drawing. The high ductility commonly essential can be improved by annealing between draws.

Frequently, however, costs can be reduced by employing a type of design which will not require too high ductility. When high ductility

is necessary, the material commonly costs more; and when annealing is required between draws, the cost of annealing—including pickling, handling, etc.—must not be overlooked. Relatively non-ductile materials are well suited for many parts when stiffness is of more importance than ductility. When a designer is not versed in the production requirements of stamped parts, he should consult an experienced stamping producer before specifying the kind or grade of metal to be used for stampings.

In the next installment of this series of articles, general considerations in the design of stamped parts will be dealt with.

* * *

Assembly Fixture for Increasing Production

An assembly fixture in which are combined many so-called time- and motion-study economy features is shown in the accompanying illustration, as devised at the Lima Works of the Westinghouse Electric & Mfg. Co. The most obvious feature is the storage of material in hoppers within easy reach of the operator's hand, as shown at *A* and *B*.

The fixture itself, as shown at *C*, is built in such a way that parts cannot be assembled except in their correct positions. When the parts are assembled, pressure on handles *D* and *E* operates plungers *F* and *G*. These plungers do not deliver a steady pressure, as in the conventional assembly fixture, but deliver several hammer blows which serve to set the rivet head on each end of the roller, thus completing the assembly. After assembly, the part is ejected into hopper *H*, from which it slides through a chute into a tote pan on the floor.

Assembly Fixture for Increasing Production and Insuring Correct Positioning of Parts

* * *

Steel Industry to Assist in Collecting Scrap

The steel industry is preparing to assist the War Production Board in collecting and moving accumulations of scrap in remote areas, according to an announcement by the Committee on Scrap of the American Iron and Steel Institute.

Because of the high cost of scrap collected in remote areas involving long freight hauls, it has been difficult to bring all this scrap to the mills. To help stimulate the collection and movement of such scrap, however, a steel industry representative will be appointed in each of several remote districts. These representatives will expedite the moving of scrap to designated plants.

This plan provides the machinery whereby every accumulation of scrap, even in remote areas, will be moved promptly to a mill that can use it. Furthermore, it will be possible to build up scrap inventories during the seasons when scrap can be most readily collected.

Estimates indicate that we will need 15,000,000 tons of iron and steel scrap during the coming six months. The bulk of this scrap must come from industrial plants, which means additional effort on the part of plant management officials. Steel presents one of the serious problems in our war production; yet recent events, instead of facilitating steel production, have retarded it. It is estimated that the miners' strike curtailed steel production by 170,000 tons. This must be made up; and besides, the War Production Board is endeavoring to obtain 1,000,000 tons above the past quota during the third and fourth quarters of the year.

* * *

If the workers are expected to heed the injunction to save to prevent inflation, Government and business should set a good example by avoiding waste.

How to Get the Most Out of Carbide Tools

Abstract of a Paper Presented by Malcolm F. Judkins, Chief Engineer of the Firthite Division, Firth-Sterling Steel Co., before a Meeting of the American Society of Mechanical Engineers

MANY of the important points relating to the use of carbide tools have been repeated again and again. Nevertheless, the advice given is not always heeded, and for that reason some of these points are repeated once more in the following suggestions.

Utilize the abrasion and hot hardness qualities of carbide tools by using high cutting speeds. Increasing the speed of cutting does not materially increase the cutting pressure, and in some instances the higher speeds reduce the cutting pressure. High speeds reduce the objectionable effects of the built-up edge and decrease flank wear and surface pitting on interrupted cuts.

Compensate for the comparative weakness of carbide tools by using light feeds. This, in turn, aids in producing high-quality machined surfaces and limits the cutting pressures. Use the minimum necessary rake, and employ small relief angles. Utilize the exceptionally high compressive strength of carbide by using a thick tip and a deep supporting tool shank.

Finally, use so-called "negative" rake angles to avoid chipping and point breakage, especially when taking intermittent cuts. Support the tool and the work as firmly as possible, and see to it that the tool point overhangs a minimum amount with relation to the face of the tool-block or cutter body. Minimize chatter and vibration by careful tool design, sharp tools, and a machine tool kept in good repair. Ascertain what are the best feed, speed, and depth of cut for the material being machined.

For best results, carbide tools should be operated at least twice as fast as high-speed steel tools. On some materials, the ratio is nearly 10 to 1.

Specific Examples of Carbide Tools in Armament Work

Heat-treated 155-millimeter shells are being rough-turned at a cutting speed of 320 feet per minute and a feed of 0.028 inch per revolution. The tools are ground after turning 75 shells. The finish-turning is performed at a cutting speed of 425 feet per minute and a feed of 0.028 inch per revolution. The tools are sharpened after 50 shells have been turned.

Heat-treated 5-inch naval shells are rough-turned at a cutting speed of 260 feet per minute and a feed of 0.020 inch per revolution. The production is 125 shells per grind. The finish-turning is done at a cutting speed of from 240 to 360 feet per minute and a feed of 0.026 inch per revolution. The production is 80 shells per grind.

Barrels for 75-millimeter guns are rough-turned with a 3/8-inch depth of cut at a cutting speed of 310 feet per minute and a feed of 0.032 inch per revolution. The hardness of the gun barrels is 300 Brinell; the cutting time is fifty-five minutes.

Boring and reaming of large-caliber cannon are now being done with carbide-tipped inserted-blade packed bits. With high-speed steel tools, the packing material was oil-impregnated maple; with carbide-tipped cutters, the body is packed with babbitt or other white metal in which plugs of maple are inserted. By using carbide tools, it was possible to reduce the time for these operations to one-third that previously required.

Rifle drilling from the solid is being widely done with both solid and tipped sintered carbide drills. Twenty-millimeter barrels are drilled at a cutting speed of 225 feet per minute. From 4 to 7 barrels are produced per grind and 75 barrels per drill. Fifty-caliber barrels are drilled at 1800 R.P.M. From 35 to 45 barrels are obtained per grind and from 400 to 600 per drill. The time required per barrel has been reduced 50 per cent and is now twenty-two minutes. The high-speed steel drills formerly used only produced 2 barrels per grind.

Heat-treated turret rings are being turned at a cutting speed of from 180 to 220 feet per minute with feeds of from 0.006 to 0.018 inch per revolution, including plunge cuts 2 1/2 inches wide. The ball-race radius is finished so smoothly that no grinding or polishing is required. Tank turrets of cast armor steel are being turned, faced, and bored at cutting speeds up to 240 feet

per minute, and drive cases have been bored at a cutting speed of 440 feet per minute, obtaining 8 pieces per grind.

Results Obtained by Hyper-Milling

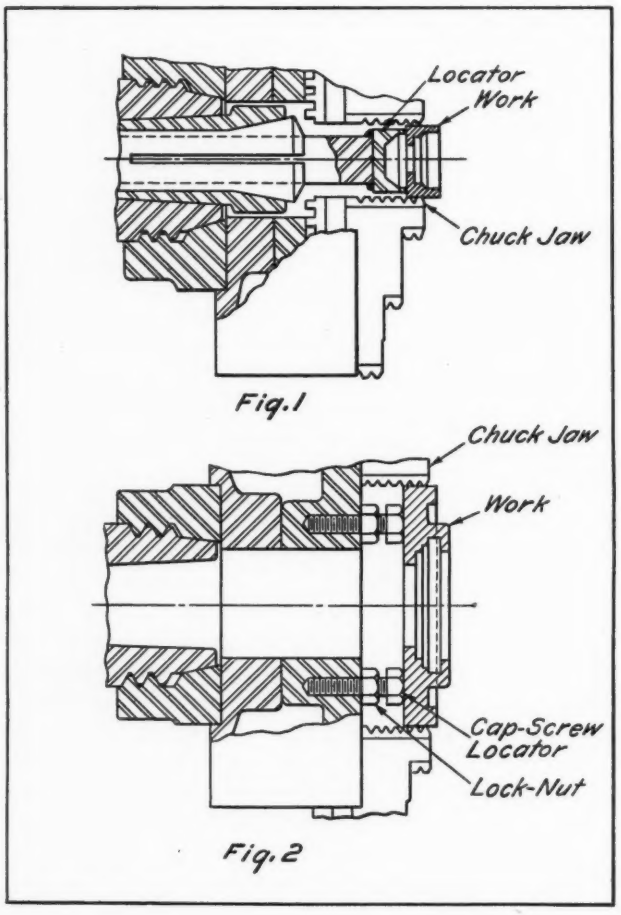
The method of hyper-milling was described in MACHINERY, September, 1942, page 186. This method has proved very successful in its various applications. One user reports results obtained on 4130 and 4340 S A E steels with a hardness of from 150 to 300 Brinell. Cutting speeds of from 1000 to 1400 feet per minute and a feed nearly always over 8 inches per minute—and occasionally up to 20 inches per minute—are used. A typical example is a forging made from 4340 S A E steel having 1/8 inch of stock to be removed over an area of 4 square inches. With a 4-inch cutter, a cutting speed of 1000 feet per minute, and a feed of 12 3/4 inches per minute, the floor-to-floor time was less than one minute for each piece. High-speed steel cutters formerly used produced about 40 pieces in a ten-hour day.

Another job involved removing 1/8 inch of stock from a forging made of 4340 S A E steel. The area milled was 12 square inches. An 8-inch carbide-tooth cutter running at 365 R.P.M. and a feed of 15 inches per minute produced 250 pieces per day. The usual production when high-speed steel cutters were used was 35 pieces a day.

Heat-treated aluminum alloy cap spars for aircraft are hyper-milled at 5400 R.P.M., which means a cutting speed of 8480 feet per minute with a 6-inch cutter having only two teeth. The feed is 20 feet per minute. This aluminum alloy is hyper-milled with so-called "negative" rake teeth.

Breech-blocks have been hyper-milled with a 1/4-inch depth of cut, a cutting speed of 730 feet per minute, and a feed 7 5/8 inches per minute, removing about 120 pounds of chips per hour, or 7.15 cubic inches per minute. The power required was 7.5 net horsepower.

In conclusion, the author said that carbides are not always the most economical nor the most efficient cutting tool materials from a power-consumption standpoint; but at a time when we need production, they are the most productive tools to employ.



Two Examples of Chucks Equipped with Simple Work-locating Devices

Work-Locating Devices Simplify Lathe Work

By F. J. YUNKER
General Electric Co., Schenectady, N. Y.

The machining of small thin parts, such as gear blanks, to close tolerances in lathes without special fixtures can be facilitated by employing work-locating arrangements like those shown in Figs. 1 and 2.

For small-diameter work, the locator shown in Fig. 1 can be used to advantage. This consists of a rod to which is welded a bushing or collar having an outside diameter slightly smaller than the outside diameter of the work, and an inside diameter large enough to provide clearance for the drill or boring tool that may be used in performing inside operations.

This assembly is placed in a draw collet in the usual way, and a facing cut is taken across the bushing end to provide a true surface for the work to rest against. The outside diameter of the work is held in a universal chuck or trued up in the usual manner.

For work of larger diameter, which can best be held by the outside diameter in a three- or four-jaw chuck, three holes are drilled and tapped in the chuck proper, and three studs are inserted and locked in place in the manner indicated in Fig. 2. When the heads of these studs are faced off to any desired length, they furnish true and accurate locating points for the work.

Engineering News

Chromium-Plating of Aluminum Made Possible by New Method

According to the Colonial Alloys Co., Philadelphia, Pa., the advantages of hard chromium plating on steel are now available for aluminum. The method is said to be quite simple. It consists of a preparatory dip of the aluminum in an alkaline solution for about one minute at room temperature. Then the plating takes place. Thicknesses up to 0.050 inch are said to have been obtained with satisfactory results. Tests of the adhesion of the plate to the aluminum indicate an adhesion strength of at least 16,000 pounds per square inch. The Colonial Alloys Co. is in a position to provide war contractors with the solutions required.

New Manufacturing Process for Making Glass Insulation

A new manufacturing process has been developed by the Corning Glass Works, Corning, N. Y., to make glass available for electrical insulation to a greater extent than in the past. That glass has exceptional qualities as an electrical insulator has been recognized since the early days of the application of the electric current; yet it is only within the last few months that the material can be said to have been made generally applicable for insulation.

Glass, when made by the conventional methods of the past, has had definite limitations—a major limitation being that the shapes have had to be relatively simple—for example, flat like a window pane, hollow like a tumbler or a jar, or long and cylindrical like a fluorescent light tube. Special designs with holes, grooves, or threads have been made, but in almost all cases by a slow and expensive procedure. It has also been difficult to hold glass parts to close tolerances to compete with metal parts.

These limitations of shape, design, and accuracy have prevented the use of glass in the electrical insulation field to the extent that the remarkable insulation qualities of glass would otherwise have warranted. Now the new process, known as "Multiform," has made glass available for insulation in a wide variety of shapes. This important development has come at a time when there is urgent need for an additional supply of insulating material, particularly in the communications field for the Armed Services. The process is applicable to a wide range of sizes, from small insulating beads, of which there may be several thousand to the pound, to large insulators weighing over 25 pounds. The insulators can be provided with countersunk and tapped holes, since both external and internal threads and grooves can be produced. Remarkable accuracy can also be obtained. In addition, the glassware can be ground and polished to extremely close tolerances if necessary.

Automatic Application of Lubricant to Conveyor Wheels

A device for the automatic application of a predetermined volume of lubricants, either oils or heavy greases, to the bearings of conveyor trolley wheels has been developed by the J. N. Fauver Co., Inc., Detroit, Mich. This lubricator is mounted on the trolley rail, so that it serves the bearings of each pair of wheels simultaneously every time they pass a given point. No independent power is needed for the device, since it is driven by the travel of the conveyor itself, and starts and stops with the motion of the conveyor chain.

As the trolley wheel approaches the lubricator, the hub engages the sleeve of one of five pumping units, which is thus automatically brought into contact with the wheel bearing. Continued rotation of the lubricator forces the pumping unit inward, so that it can deliver a measured quantity of lubricant to the wheel bearing. This operation is performed on the bearings of both wheels of a pair at the same time.

Plastic Employed in Producing Spray-Gun Bodies

Spray guns with plastic bodies are now being produced by the Eclipse Air Brush Co., Inc., 400 Park Ave., Newark, N. J. The new black plastic gun weighs 1/4 pound less than the spray gun with aluminum body that it replaces. The plastic used in this gun is strong and has good impact strength. It also has good chemical resistance, and is not affected by thinners, solvents, or paint removers. These guns have been giving satisfactory performance in shipyards, aircraft factories, and munitions plants, where equipment of this type is in constant use under strenuous conditions.

Editorial Comment

Industry has changed over all its facilities to war work; all its resources are centered on one purpose—winning the war. Although it is essential that our activities be devoted to this one purpose, it is important to direct our thoughts now to the day when these facilities must be again converted—converted to peace production and to the employment of the war workers and the men in the Armed Forces returning from a task well performed.

Planning Employment for the Days When the War is Won

Millions of men will return from the fighting fronts at the very time when other millions will no longer be needed for making war equipment. Is it out of place to plan now for what we shall do when that day comes? Because surely a plan is needed. The plan that is wanted, however, is not an over-all Government plan, nor is it an all-inclusive industrial plan. The plan required is one that concerns each individual manufacturing organization—each individual business.

What are the conditions in the country likely to be when the war ends? Apart from the fact that millions will lose their war jobs and be looking for peace jobs, the industrial picture is not discouraging.

The workers in this country will have earned big wages; a good portion of these will be in War Bonds which will be converted into cash in order that the money can be spent for things that no one has been able to buy during the war—automobiles, refrigerators, radios, vacuum cleaners, electrical appliances, and so forth. There is likely to be plenty of money to be spent for whatever products industry has available.

Industry Must be Ready to Meet Its Post-War Problems

There is also likely to be an appreciable export trade, because the world can use the products of our factories and will arrange somehow to pay for them. It is possible that American industry will have the largest potential markets in its entire history; but industry must be ready to supply the goods. And to give thought now to how that may be done need not interfere with the war effort.

If private industry is not ready, on the one hand, to supply this demand, and on the other, to take up the slack in employment, Government is sure to step in to try to do what industry could do better and less expensively. That is another good reason for doing a little *thinking* now about post-war plans while *producing* war equipment to the fullest extent possible.

In the last couple of months, production in the war equipment plants has not met expectations, according to Donald Nelson, chairman of the War Production Board. This is a most serious condition. Partially it is due to strikes, absenteeism, and a letting down in previous efforts. Partially it may be due to the wholly erroneous assumption that this country now has such a supply of munitions on hand that extreme production efforts are no longer necessary.

Make Home Front News As Good as the News from the War Front

Nothing could be farther from the truth. The real shooting war has not yet begun as far as the United States is concerned. We have nowhere nearly reached the fighting intensity of our allies the Russians, for example, and until we do, the conquest of Nazi Germany cannot be accomplished. Besides that, we need enormous quantities of war equipment and supplies to defeat our still very powerful enemy in the Pacific.

Manufacturers and workers alike must realize that during the last six months of this year we must produce 50 per cent more munitions than we produced during the first six months. Instead of less effort in munitions plants, there should be greater effort. Management must do its part, and the workers must fulfill their obligations. The soldier who goes into battle cannot go on strike. The worker on the home front is just as much on the battle line, and strikes in industries essential to war production are little short of treason. Thousands of young American men may have to die if the war is prolonged unnecessarily a single day because munitions are not ready on time. The home front must do its part.

Industry Plans for the Future

To Insure a High Level of Employment in the Days of Peace to Come, Leading Men in Industry are Giving Serious Thought to the Production Problems of the Future

By PAUL G. HOFFMAN
President, The Studebaker Corporation
Chairman, Committee for Economic Development

IN mechanized warfare, the balance inevitably swings sooner or later toward the side with the greatest mechanical industry. We already have seen the beginning of that swing. The fact that it has started so soon is a tribute to the resourcefulness, ingenuity, and drive of manufacturing executives and workers alike in the war plants throughout the country.

Let us never for a moment forget, however, that equipment alone is not enough. It takes men willing to make the greatest sacrifice to put that equipment to use. Victories are not won by machinery itself, or by the men who produce it, but by the men using it on the fighting line. The only real heroes in this war are in the combat zones. We on the home front have been put to some inconveniences by the war, but we are making no real sacrifices in the sense that the men on the fighting front are.

It is our job on the home front to keep a stream of war supplies flowing to the fighting front; for without equipment, the finest leadership, courage, and fighting ability are hard put to win victories. While doing this, it is also our job to take practical steps to assure that we will make our maximum contribution toward continued high-level production when peace comes. This involves provision of jobs for our fighting men when they return, as well as the continuance of jobs for war industry workers. This is an obligation every one of us in America must assume. The men at the fighting front depend on us not to let them down.

The assumption has been made by some that there is a conflict between working to win the war and making preparations for peace. There should not be; there need not be; and there must not be. Winning the war has a triple-A priority. Nothing must be allowed to interfere in the slightest way with the gaining of that objective. Industrial preparation for peace, however, need in no way interfere with war production.

On the contrary, by giving assurance to war workers and fighting men alike that they will not be let down at the end of the war, confidence is created and morale is stimulated. American industry has progressed through its ability to plan for the future while doing an efficient job in the present. To assume that it cannot do so now is to deny the continued existence of one of the qualities that has made industrial America great.

We have paid a terrific price in blood and sweat for being unprepared for war. We might pay an equally devastating price for being unprepared for peace. Taking no thought for the future at this time would put American conceptions of freedom in the greatest jeopardy. We made the mistake in World War I of failing to prepare for peace. To repeat that mistake now would be more than stupid; because of the vast upheavals and dislocations prevailing in the world, it would probably be fatal.

For this reason, a Committee for Economic

Development has been formed, the purpose of which is to stimulate individual initiative in developing practical means for continuing high-level employment—which, of course, means high-level production—with the minimum of interruption at the end of the war. This committee is giving special emphasis to the study of recent developments in materials, equipment, methods, and technique, particularly where these point to new possibilities in peace markets.

The problems that peace will bring are numerous and complex. In addition to international matters—monetary confusion, world policing, etc.—a large number of domestic policies need challenging in view of the new conditions that will prevail in the post-war world. But important as all these questions are, our hope of achieving a better world rests largely upon our ability to develop and maintain high-level peacetime employment and production.

There can be no better world unless America is strong and free. America cannot remain strong and free if, after the war, we have too much unemployment for too long. That would be a direct invitation to dictatorship; on that point there is general agreement. Perhaps it is not so clearly recognized that if Government furnishes too much employment for too long, the result will be similar. Too much Government employment results in staggering deficits, political corruption, and deterioration of the character of our people. Either too much unemployment or too much Government employment will mean regimentation to replace free enterprise; our free society would give way to some form of state socialism.

How the Committee for Economic Development Started Its Work

When the Committee for Economic Development was organized, its members realized that if they hoped to make any contribution to the solution of the post-war employment problem, their first job was to establish the facts. To develop the facts, they went back to 1940, our last peacetime year. It was found that approximately 46,000,000 people were gainfully employed in the United States in that year; less than 600,000 were either in the Armed Forces or engaged in armament production. It is estimated also that from 6,000,000 to 9,000,000 competent workers were unemployed.

In contrast to 1940, it is estimated that by the end of this year more than 62,000,000 people will be employed in our fighting and working forces, of whom no less than 20,000,000 will be engaged in the manufacture of war equipment. If we had to provide employment for this large number after the war, the task would be staggering; but this is not likely.

Employment Estimates for the Peacetime Years to Come

Assuming that several million women, along with over-age and under-age men, will return to their homes when the war is over, economists estimate that we will have to provide 58,000,000 jobs with a normal work-week to have a satisfactory level of employment. Approximately 2,000,000 of these will be in the Armed Forces. The Government normally employs approximately 3,000,000 people.

In addition, there will be an obvious need for a post-war public works program. Highway building and maintenance has been neglected, so that our highway system will have to be reconstructed to a large extent in order to meet modern traffic conditions. New residential building and slum clearance will necessitate modernization and new construction of such essential services as water works. The expansion in civil aviation will require a huge airport construction program. All of this, it is estimated, will employ about 3,000,000 men. This leaves about 50,000,000 people who will be looking to industry, commerce, agriculture and the professions for work.

That is the goal as far as jobs are concerned. High-level employment could be attained very easily if we disregarded the reasons for its attainment—a high standard of living and the maintenance of age-old American freedoms. A twenty-hour or even a thirty-hour week might cure unemployment, but at the same time might plunge America into poverty. Jobs might be created by turning our backs on technological advances—but at what cost to our living standards! The only way in which we can attain the triple objectives of high-level employment, high-level production, and high-level living standards is by taking advantage of every technological advance.

Prime Factors to be Considered in Planning for the Future

To attain the triple objectives stated, we must increase our gross output of goods and services more than 40 per cent over the record-breaking peacetime year of 1940. In that year, our gross output was $98,000,000,000. After we have made the transition to peacetime production, our annual output must be approximately $140,000,000,000, measured in terms of the 1940 dollar. If we face these facts, two conclusions are inescapable:

1. Individual enterprises must start *now* to plan their own peacetime products for peacetime markets.

2. The environment in the post-war period must be favorable to the expansion of enter-

prise. Policies of Government, business, and labor must be directed toward the achievement of a more dynamic economy.

How can this be accomplished? First let me say that I have no confidence whatever in the ability of any agency—public or private—to make over-all plans for our economic system or business program. However, I have the highest confidence in the ability of individual business men to plan for the future of their own business. The initiative and resourcefulness of the individuals in this country constitute one of our greatest national resources. The problem is how to develop this great resource and how to stimulate hard thinking on the part of business men.

Organization and Background of the Committee for Economic Development

The Committee for Economic Development is composed of a board of eighteen trustees, twelve regional chairmen, and approximately one hundred district chairmen. The committee is independent and self-financed, but has the active support of the Department of Commerce. Furthermore, it has been assured the cooperation of other governmental agencies and of great national business organizations.

The responsibility for the committee's activities rests with its Board of Trustees. Its activities are carried out through two major divisions—the Field Development Division and the Research Division. Marion Folsom, treasurer of the Eastman Kodak Co., a member of the Board of Trustees, heads the Field Development Division; Ralph Flanders, president of the Jones & Lamson Machine Co., also a member of the board, heads the Research Division.

Work of the Field Development Division

The Field Development Division has the responsibility of stimulating, encouraging, and helping individual enterprises in planning their post-war products and marketing. There are actually 3,000,000 business establishments in the United States, but of these approximately 1,000,000 are one-man concerns; of the remainder, 1,850,000 employ from one to eight persons, and 150,000 employ from nine up. Approximately 500 concerns may be classified as large employers.

The efforts of the Field Development Division are directed toward the smaller, as well as the larger, businesses, because the former provide many millions with their livelihood. Furthermore, it is the smaller businesses that need most encouragement and help, and all possible cooperation should be extended to them because they are essential to our country. Employers, large and small, are the shock troops on whom we must rely to plan for the sharp increase in production that will, in turn, provide high-level peacetime employment.

The first effort is to provide "know how" information to all business men. To this end, an Industrial Advisory Board has been appointed, which is composed of our foremost experts, not only in the field of planning for individual enterprises, but from the standpoint of knowledge of new materials and technological methods. The studies of Dr. S. M. Livingston under the title "Markets after the War" are an important part of this work.

Collecting planning information is only one of the functions of the Field Development Division. It must also be distributed as widely as possible. This is done in three ways: First, through direct contact with the large corporations; second, through trade associations; and third, through community activities.

The setting up of local Committees for Economic Development presents the greatest difficulty, but also holds the greatest promise. If the right community leaders can be secured, very little help will be required from our national committee. The goal is approximately one thousand local committees. To obtain distinguished local leadership, the cooperation of prominent men in business and industry has already been secured. The national committee asks for no authority over the regional, state, or community chairmen, but it is strongly urged that the local committees be sponsored by, or collaborate with, existing organizations. In most cities, the committee works closely with the local Chamber of Commerce.

The national committee stands ready to extend all possible assistance to the local committees. In return, the local committees give the national group the benefit of whatever new ideas they may develop, so that these can be passed on to other local committees. This plan of operation has already been found to be well justified. Perhaps out of a small western town may come an idea that will mean jobs for thousands in New York—who knows?

Work of the Research Division

The Research Division is concerned with the creation of conditions in the post-war period favorable to the expansion of enterprise. All policies of Government, business, and labor that interfere with expanding employment should be challenged and changed. All policies should be considered only with reference to the general public welfare.

As mentioned, the research group is headed by Ralph Flanders, who combines clear vision with hard common sense, and who has associated with him a group of eminent business leaders.

This group cooperates with a Research Advisory Board.

In setting up this division, as stated, the committee recognized that the criterion by which the policies adopted should be judged is that of the general public welfare, and therefore, did not suggest that studies of these policies should be undertaken by business men who, consciously or subconsciously, might be prejudiced. They proposed rather that a research staff of university economists be organized and instructed to carry forward studies, with the sole objective of suggesting changes that would help us maintain a free and dynamic society.

Among the research projects now under way are the following: Incentives for business enterprise and the effect of taxation on those incentives; post-war reconversion problems; cancellation of war contracts; disposal of Government-owned plants and surpluses; removal of wartime production, inventory, rationing, and price controls and priorities; monetary and banking policies; changes in the tax structure; financing reconversion and rehabilitation of industries; transfer of workers to peacetime jobs; provision for unemployed workers during the transition period; post-war problems of agriculture and of international trade and finance; and a survey of the special problems pertaining to small business.

The committee hopes to obtain worthwhile results by bringing together business men and economists, and by making use of the practical experience of the former and of the detailed studies of the latter. Any policies of business that are not in the general public interest should give way to new conceptions, as should also any such policies of Government and of labor. *We may win the war, but we will not "win the peace" unless business men are willing to be Americans first and business men second. Similarly, labor leaders must be Americans first and labor leaders second; and this also goes for the farmers and the Government administrators.*

Concluding Remarks

This, in brief, is the way in which the Committee for Economic Development is endeavoring to help commerce and industry to get ready now to provide employment when peace comes. The prospect is hopeful because peace, when it comes, will find a huge pent-up need and desire for goods, and billions of dollars of savings available to permit people to translate their desires into buying demand. The problem of industry will be to meet the demand, not to create it. The prospect is inspiring because, in Donald Nelson's words, we are on the edge of a new world—and what a chance we have to make that a better world than we have ever known in the past, the kind of world that really was worth fighting for.

Business must be ready to act quickly and surely when the time comes. That is why we must plan now and plan boldly. When once peace comes, industry must be ready to race to high-level employment. Industry and other segments of the economy must be ready to provide jobs for millions of returning servicemen and idle war workers. This must be done before long unemployment brings fear and disillusionment and want. If business has planned boldly and has the courage to act boldly when peace comes, its wheels can begin to turn in time.

This is an obligation that rests with employers—large and small—an obligation that we cannot escape. Men are fighting and suffering and dying all over the world to protect your freedom and mine; the least we can do is to assure them a better post-war world, a world not only of security, but of security with opportunity.

* * *

Resistance of Concrete Increased by New Development

A new product that makes concrete several times more resistant to weather and abrasion in dams, fortifications, and construction projects of all types has been developed by the United States Rubber Co. The product is an absorptive lining for forms in which concrete is poured, and is known as "Hydron." It is light, easily handled, and flexible enough to fit curved surfaces.

By removing water and air bubbles from the surface of the concrete, Hydron aids in producing a concrete that will last longer and will have a smoother and more pleasing finish without brushing or scraping.

In tests made, samples of concrete were held within 2 inches of an air blast delivering sharp steel grit at 20 pounds air pressure. With concrete cast against ordinary wood forms, the blast dug a hole 1/4 inch deep in one minute. With concrete cast against Hydron, the particles bounced off the "casehardened" surface, leaving a barely perceptible mark. In weathering tests, where samples were repeatedly frozen and thawed, concrete cast against Hydron withstood four times as many cycles as samples cast against wood.

The Hydron form linings consist of an absorptive material faced with a fabric. The linings are easily applied to the concrete forms by stapling. After the concrete has been cast, the forms are removed, and the fabric is easily peeled from the concrete, leaving a smooth surface that needs no brushing or other refinishing operation.

Employment of Disabled Members of the Armed Forces

The War Manpower Commission has issued a statement of "Policy on Re-employment and Placement of Veterans," the purpose of which is to provide employment for members of the Armed Forces who are returning home. Full and effective utilization of returned veterans through re-employment, rehabilitation, and training is the Nation's responsibility. The War Manpower Commission, through its various agencies, will endeavor to place returned veterans in gainful and essential employment or refer them to proper agencies for rehabilitation and training.

To provide a rapid and orderly procedure of employment or re-employment of veterans as they are returned to civil life, the Commission, through the Re-employment Division of the Selective Service System, will continue to aid in reinstating veterans in former jobs, or to find employment for them through the local U. S. Employment Service. The offices of the latter will provide registration and placement services to returned veterans who were not employed when inducted into service, or who do not wish or are unable to return to their former work. In doing this work, the Commission will work in close cooperation with the War and Navy Departments, the Veterans' Administration, the American Red Cross, and Federal and State rehabilitation and training agencies.

* * *

High-Strength Parts Made from Powdered Metals

According to *Production Information*, published by the Automotive Council for War Production, several new high-strength materials made by powder metallurgy, among them two called "Stressite" and "Damascite," have recently been introduced. They are among the materials being adapted to war products that help to relieve the load on machine tools. For example, ordnance parts, formerly made of castings, stampings, forgings, tubing, or bar stock, are being made by briquetting powdered metal to shape, sintering, and sizing.

The range of the materials is wide, all the way from porous, oil-impregnated bearing materials to high-strength materials for machine parts. Within the limitations imposed by the briquetting dies, machined shapes can be duplicated accurately, including ball-bearing retainers, levers, gears, and irregular shapes. Parts up to 18 inches in diameter are now made by this process.

Powder metallurgy is destined to play an increasingly important part in the mechanical industries in the future.

Is Productive Efficiency at Its Maximum?

In a monthly digest published by Stevenson, Jordan & Harrison, Inc., management engineers, it is stated that everyone who has extensive contact with production conditions in various plants throughout the country is aware of the fact that it is the exception, rather than the rule, that labor is operating at its highest possible level of productivity. This fact is attested to by many production executives. Among the more important reasons for this situation are these: (1) Union rules, policies, and habits; (2) failure to realize the importance of greater effort; (3) lack of incentive to earn more because earnings are already higher than usual; (4) fear of having work or materials "run out;" (5) high rate of job turnover; (6) lack of adequate training and supervision; (7) the normal legalized forty-hour work-week.

Other factors that are responsible for holding down production include time lost in settling grievances; absenteeism because of high earnings; and availability of other jobs.

It is stated that production generally could be increased 15 to 25 per cent with no increase in the number of workers employed if these restraints and influences could be removed. An even larger increase would be possible in most cases if work simplification was pushed to a maximum, if sound wage incentive systems were established with the cooperation of the unions, and if training and supervision were made adequate.

* * *

New Bonding Method for Metal and Other Materials

A method of bonding metal to metal, or rubber, plastics, leather, or wood to metal, or to each other, with a bond said to be, in most instances, stronger than the materials themselves, has been developed by the U. S. Stoneware Co., Akron, Ohio. The new process, known as the Reanite bonding process, develops a bond, when applied to metal-to-metal, which, in repeated tests, is said to have shown itself stronger than riveted or spot-welded joints. On tests of bonds between rubber, plastics, leather, and wood, the materials themselves gave way before the bond.

The application of the process is simple. The surfaces to be joined are brushed, sprayed, or dipped with Reanite; after drying, gentle heat and pressure are applied.

Reanite joints are said to be unaffected by fresh or salt water and to possess good corrosion resistance. The new process is being used for airplane sub-assemblies, motor mounts, etc.

How to Secure Fine Surfaces by Grinding

By H. J. WILLS, Engineer
The Carborundum Co., Niagara Falls, N. Y.

Fifth of a Series of Articles Describing the Factors Governing Fine Surface Quality and the Means by which This Quality Can be Obtained—The Present Article Deals with the Selection of Dressing Tools

ALTHOUGH the same tools are used for dressing and for truing grinding wheels, there is a clear distinction between the two operations, since the purposes and the methods used are quite different. The face of a wheel is dressed to secure the desired cutting action; it is trued to maintain or change its shape, or to maintain its concentricity or the parallelism of its sides.

Most of the dressing tools that depend for their action on steel stars or disks, while highly efficient for dressing roughing and semi-roughing wheels, are not suitable for dressing wheels to be used for fine grinding. However, the locked-disk type can be used for dressing wheels to grind such parts as camshafts and crankshafts, where the final surface is finished by lapping.

A tool, the dressing element of which is a solid steel cylinder with either one or two spiral grooves, can be used for dressing wheels to obtain surfaces of about 8 micro-inches r.m.s. Those with a single groove are suitable for producing the wheel surface needed for the fine grinding of cast iron.

If, as is often desirable, a wheel is to be used both for the roughing cut and for the subsequent finishing cut to produce a high quality of surface, the dressing for the roughing cut may well be done with an abrasive stick, while a diamond is used for dressing the wheel for the finishing cut. This procedure saves diamonds and gives as good results as if a diamond were used for dressing the wheel for both cuts.

For some jobs, where the surface required is not quite of the high grade of fine grinding that we are considering in this series of articles, a dresser, the cutting element of which is a silicon-carbide abrasive wheel, can be effectively used in place of a diamond tool. Some of these dressers are held in the hand, while others are rigidly mounted in the grinding machine.

Properly used, these dressers produce a smooth, clean cutting face on the wheel, leaving no dressing marks on the work. Their use does not require great skill on the part of the operator. The dressing wheel is supported in its mounting on a high-grade bearing—the better the condition of the bearing, the better will the grinding wheel be dressed. The dressing wheel is held against the grinding wheel at a slight angle, and is revolved by the grinding wheel. Its action is a combination of crushing, wiping, and shearing. Some suggestions as to the most effective use of dressing wheels will be given in the next article of this series.

Diamond Dressing Tools

For really fine dressing, the diamond tool is generally used. In recent years, great improvements have been made in diamond dressing tools, not only to give better results, but to reduce the cost of using diamonds. Of the various types of commercial diamonds, probably 85 per cent of the machine shops in this country prior to the war used African brown bort, gray bort, or ballas stones, because, on the average, they give the best service at the lowest cost. Today, in the United States, we are using Brazilian stones only. While brown and gray bort stones are somewhat cheaper, the ballas (meaning "round") stones are superior for some work.

Gray and white bort stones are the hardest, but they are very brittle, and therefore easily shattered by a shock or blow. A skillful operator can use these stones without undue breakage, but it is recommended that newly trained grinding machine operators be provided with tools using the best quality of brown bort stones. These are not so brittle, and therefore will stand more abuse than any other kind of bort stone. They are hard enough to withstand considerable wear, and are less expensive than some of the finer stones, which can safely be used only by careful, experienced operators.

Diamonds used for wheel dressing may be octahedral in shape, elongated, or round. Actually, all of these are eight-sided, but the shape is more pronounced in the so-called "octahedral" stone than in the others. The useful dressing points are what are known as the "four-

point locations," where the four sides of the stone come together, and the "two-point locations," which are, in reality, not points but the edges where two sides of the stone join. Between these "points" are faces of the stones that are flaky and of no value in dressing.

The accompanying table gives a method for determining the size of diamond generally recommended for various kinds of dressing service. The recommendations in the table are not intended to be followed as hard and fast rules. No two stones are identical in their characteristics. Furthermore, the cutting quality and life of the stone depend upon such variables as the position of the stone in the mounting, the mounting material, the method used in mounting, and the personal element injected by the operator. The latter is very important. One operator using a 3/4-carat stone may get longer life and better service from it than another from a 3-carat stone. The principal reasons for selecting stones for various dressing conditions by size are to provide the needed strength of stone and setting, and to enable heat to be dissipated rapidly from the stone.

Holding the Diamond in the Tool

The diamond may be held in the tool by means of copper or some alloy, which must be poured around the stone in a molten condition, or by one of several matrixes, among them tungsten carbide.

The disadvantage of the first means for holding the diamond in the tool is that there is danger of the molten metal burning the stone after several resettings. Stones should be reset as soon as the exposed point, which has been doing the cutting, becomes dull. Because resetting takes the tool out of use and is expensive, there is a tendency to use the stone after the point has become dull. This precludes fine grinding, for a dull diamond will not dress the wheel to the essential free-cutting condition; the abrasive grains may be crushed into the wheel face and be torn out in use, causing serious blemishes on the work; and the wheel face is prone to glaze.

It is not safe to leave the determination of the time for resetting to the judgment of the operator. Simple gages are available which, applied

Table for Selecting Diamond Size

"F" Rating	Wheel Diameter, Inches	Wheel Face, Inches	Grit	Grade	Bond	Abrasive
1	Up to 6	1	40 to 80	Soft	Vitrified and Silicate	Al_2O_3
2	6 to 12	2	.....	Medium	Shellac	....
3	12 to 16	..	90 and finer	.....	.....	....
4	16 to 20	3	.....	.....	Resinoid	....
5	20 to 24	..	.....	.....	.....	....
6	24 to 30	4	12 to 36	Hard	Rubber	SiC
7	30 to 36	..	.....	.....	.....	....
8	36 to 40	5	.....	.....	.....	....
10	.....	6	.....	.....	.....	....
12	.....	7	.....	Very Hard	.....	....
14	.....	8	.....	.....	.....	....
16	.....	9	.....	.....	.....	....
18	.....	10	.....	.....	.....	....

Value of Total Rating "F" In Carats

"F" Values.....	6	9	12	15	18	21	24	27	30	33	36	39	42	45	48
Size Stone, in Carats	1	1.5	2	2.5	3	3.5	4	4.5	5	5.5	6	6.5	7	7.5	8

Example of How to Use the Tabulated Values Above

	Diameter	Face	Grit	Grade	Bond	Abrasive	Total "F"	Size Diamond
Wheel Specifications	24	6	50	Medium	Vitrified	SiC	....	....
"F" Value.....	5	10	1	2	1	6	25	4 Carats

In the example of how to use the tabulated values above, note that opposite the 20- to 24-inch wheel diameter, the "F" rating 5 is given; likewise, opposite a wheel face of 6 inches, the "F" rating 10 is given. Grit 50 comes in the group "40 to 80" grit for which the "F" rating is 1. Opposite medium grade, we have "F" rating 2; and opposite vitrified bond, we have "F" rating 1. Finally, opposite the abrasive SiC, we have the "F" rating 6. The total of all these ratings is 25, and, in accordance with the table above, this would mean a 4-carat diamond, since 4 carats corresponds to 24 (the nearest "F" value) given in the table. The "F" rating is simply a numbering system adopted for convenience.

to the dressing tool, show whether the point has been worn enough to require resetting. In general, that time has come when 10 per cent of the area of the exposed part of the stone has been worn flat.

Great damage can be done to the diamond if the heat generated in dressing rises to a point where the stone will loosen in the mounting. To prevent this, some tools are equipped with cooling fins or channels which enable the coolant to flow close to the stone mounting.

There are several matrixes used for mounting that need not be raised above room temperature in order to make a perfect union with all parts of the stone. Their use prevents the burning of the diamond by molten metal, and yet the union assures that the stone is tightly held. Some of these matrixes permit the entire stone to be used up without resetting, since the matrix is ground away without harmful results.

As will be explained in the next installment of this series, it is often desirable to present the diamond to the wheel at various angles. Since the holders supplied with the grinding machine may not always permit a wide enough range of angles, some diamond-tool manufacturers provide nibs, set at the correct angles.

Dressers or Dressing Tools with Several Diamonds

So far we have been discussing single-stone tools in which, to avoid too frequent resetting, quite large diamonds are usually employed. For a long time but little use was made of the smaller stones, which constitute by far the largest supply of high-grade stones. To reset these small stones as frequently as necessary becomes very expensive.

However, some excellent tools have from three to seven small stones set on the face. In the seven-stone tools, from two to four of the stones are in contact with the grinding wheel simultaneously, each bearing its part of the load. By turning the tool from time to time, the points are kept sharp.

A tool that has six diamonds has been developed for use on wheels of from 100 to 500 grit, to be used in producing a particularly fine surface. The six stones are set in the face of the tool in a plane parallel to the grinding wheel axis. The first stone takes a roughing cut, while each of the remaining five stones takes successively finer cuts. This, it is claimed, insures that the face of the wheel will be properly dressed and left absolutely straight and true.

Obviously, the stone that is used for taking the roughing cut will wear more rapidly than those that take the lighter cuts. When this happens, the diamond-holding part of the tool can be so turned that the stone which formerly took the lightest cut becomes the "lead" stone, taking the heaviest cut.

A comparatively recent development is a dresser that contains three rows of three diamonds each. These rows are so staggered that when the outer or top row of three diamonds becomes worn, the stones of the second tier come into cutting position, and, similarly, the stones in the third row come into cutting position when those in the second row become worn. Once adjusted to the wheel, the tool does not have to be disturbed. The stones are completely consumed without resetting. The holder remains as originally set until the last tier of stones is worn away. Most multiple-stone tools dress the wheel with a row of diamonds that is parallel to the axis of the wheel. This one is brought to the wheel so that the three stones cut in a plane at right angles to the wheel axis, in the same track that is cut by the "lead" stone.

Still another design of diamond tool uses several small stones set in tandem in the matrix. This tool is used in the same way as a single-stone tool, except that when one stone is used up, the next one is brought into use by grinding back the matrix. No resetting is needed.

A tool that is intended only for fine grinding consists of a matrix impregnated with a large number of small diamond particles. As the face of this tool wears down, it is turned a quarter of a turn to present new stones to the wheel. This is continued until all the stones and the matrix have been ground away.

The next article will tell how to use dressing tools so as to give the grinding wheels the characteristics necessary for fine grinding.

* * *

Concentricity Testing Fixture

The fixture shown in the accompanying illustration was developed at the Link-Belt Co.'s Dodge plant in Indianapolis by Joseph H. Kautsky for testing the concentricity of the finished outside cylindrical surface of a cone with its bore. For this development, Mr. Kautsky received a gold medal from the hands of President Roosevelt, with a citation of "production merit." Previous to the development of this fixture, no adequate equipment was available by which the operator of the grinding machine could determine the accuracy of his work.

The expansion mandrels on which the cones are mounted for grinding the cylindrical outside surfaces are small and subject to distortion if carelessly employed. Dirt or a small chip on the bearing surface, or the application of too much tightening pressure on the mandrel, for example, can cause inaccuracies that may easily escape the operator's notice.

Previous to the development of the inspection fixture, the grinding machine operator was obliged to employ an inefficient and unsatisfactory method of checking the concentricity of the outside surface with the bore of the work. Since there were no precision mandrels or arbors on which to mount the work, the plug end of a taper-lock plug gage was knocked out of its handle and used as an arbor for the cone to be tested. Not having the proper tools for removing the plug from the handle, it was altogether too easy to damage the gage and handle. Then there was the disadvantage of taking the plug gage from its regular work.

After mounting the cone on the plug-gage end, it was taken to the Brown & Sharpe testing centers, which were located at a considerable distance from the grinding machine. Here more time was usually wasted in waiting for someone to finish up his work with the testing centers. If the Brown & Sharpe testing centers showed the work to be out of true, the operator returned to his machine and made adjustments calculated to bring the work within the required specifications. After resetting the machine, a new piece or cone was tested as described. The machining, testing and resetting operations were repeated until cones of the required accuracy were produced.

By providing fixtures like the one shown in the illustration, and as many arbors or mandrels *A* as required to accommodate all the different sizes of cones made, it has been possible to substantially increase production and maintain closer control over accuracy.

Base *B* of the fixture is 7/8 inch thick by 6 inches square, and is made of cold-rolled steel. The centers *C* and *D* between which arbor *A* is held are mounted in posts *E* and *F*. Center *C* is held securely in a fixed position by a set-screw *G*. Center *D* is a sliding fit in its housing *H*, and is backed up by a spring *I*, which exerts a uniform pressure on the arbor.

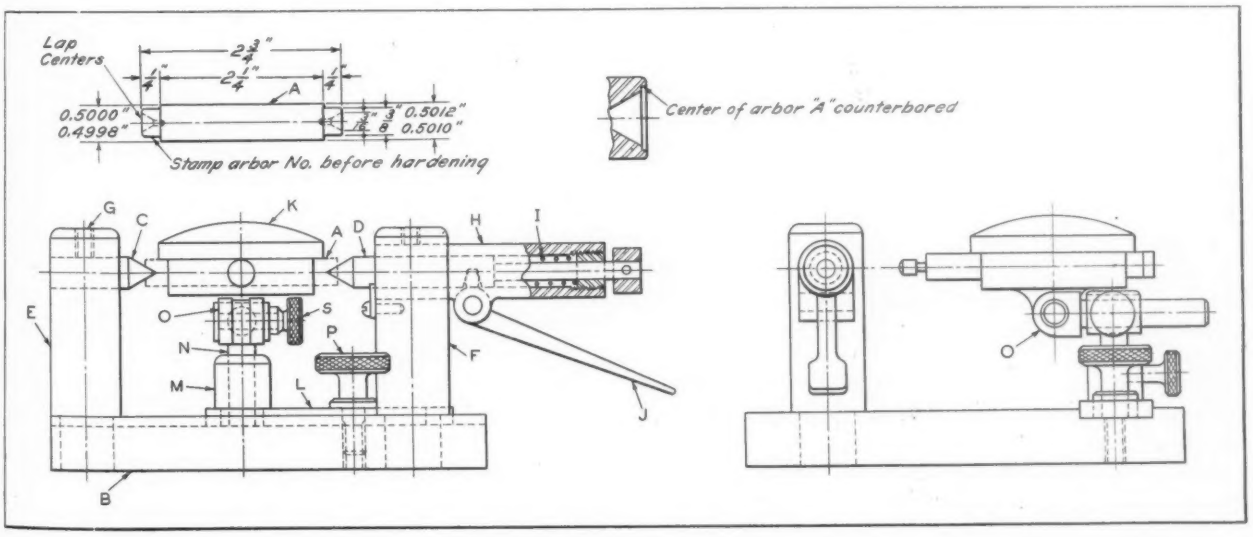
A lever *J* having a single gear tooth that fits into a tooth space in center *D* provides means for releasing the arbor from between the centers and for withdrawing center *D* to permit inserting a new arbor. By simply pressing down on lever *J* center *D* is withdrawn, so that the arbor can be removed. Releasing the pressure on lever *J* permits spring *I* to force center *D* into the center in the left end of the arbor that holds the piece to be tested.

The dial indicator *K* is supported by a bracket consisting of members *L*, *M*, *N*, and *O*. The knurled-head screw *P* serves to clamp member *L* in place after the latter has been adjusted horizontally to bring the work-contacting anvil of the indicator gage into the required position, knurled-head screw *S* being tightened to hold the anvil spindle of the indicator at the required height from plate *B*, with the center line passing through the center line of the work-supporting arbor.

Arbor *A* is one of sixteen different sizes made for use in testing or inspecting cones. The smallest of the arbors has a minimum diameter at the small end of the taper of 0.1893 inch, while the largest arbor has a minimum diameter at the small end of 1.1558 inch.

* * *

An indication of the tremendous increase in railroad passenger transportation is found in transportation figures recently compiled. In 1939, a total of 28,114 passenger cars accounted for 22,651,000,000 passenger-miles. In 1942, a total of 27,995 cars accounted for 53,676,000,000 passenger-miles.



Concentricity Testing Fixture with One of Sixteen Different Sizes of Work-holding Arbors A

Materials of Industry

THE PROPERTIES AND NEW APPLICATIONS OF MATERIALS USED IN THE MECHANICAL INDUSTRIES

Plastic Protects Threads During Electroplating

Landing-gear struts for airplanes can be chromium-plated twice as fast by using a tube of Lucite methyl methacrylate resin to protect the threaded end during plating, according to the plastics department of E. I. duPont de Nemours & Co., Inc., Wilmington, Del. This plastic, when used in electroplating baths, has been found to be more durable than such materials as rubber, lacquered wood, and certain phenol-formaldehyde plastics that tend to deteriorate or contaminate the solution.

Plastic insulators are now used in connection with the electrodeposition of chromium on steel, brass, and bronze parts for military equipment. The Thomas-Thiel Co., of Wilmington, Del., forms the insulators from plastic sheets and rods in its own plant. 201

Composite Steel for Cutting Tools Saves High-Speed Steel

Considerable savings in the use of high-speed and other alloy steels in cutting tools have been made possible through the development of a composite steel by the Jessop Steel Co., Washington, Pa. This steel consists of a section of alloy steel, continuously and permanently bonded to a backing of mild steel. The use of this composite metal results in substantial savings in material costs and in critical alloys, and at the same time, the inserted or clad section gives the performance of a solid alloy piece. 202

New Solvent Developed as Substitute for Carbon Tetrachloride

A new solvent, described as a volatile methylated hydrocarbon which evaporates clean and is non-flammable and non-corrosive, has been developed by the Curran Corporation, 6 Pleasant St., Malden, Mass. This solvent is characterized by its quick and powerful dissolving action on gums, oxidized oils, burnishing compounds, etc., and is said to be fourteen times faster than naphtha in cutting gummy and tarry dirt. It is a "non-polar" solvent, and induces no corrosive or rusting tendency in ferrous metals. It is also claimed to be less toxic than carbon tetrachloride, for which it is a substitute. 203

Protection for the Coils of Rustproofing Systems

A protective coating material designed especially for use on steel coils in rustproofing systems has been developed by the Michigan Chrome and Chemical Co., 6340 E. Jefferson Ave., Detroit, Mich. In ordinary practice, the coils in rustproofing systems that are in constant use must be removed and cleaned approximately every two weeks. It is often necessary to pound the coils with a sledge to remove the heavy deposits, and nearly a day may be required by one man to complete the job. When the new coating, known as "Koilkote," is applied, it is claimed that the coils need be cleaned only once in five or six weeks, and the actual cleaning time is usually less than one hour; thus there is a marked saving in time. 204

Stoody 1 and Stoody 6—Two New Hard-Facing Alloys

Two hard-facing alloys of cobalt, chromium, and tungsten, known as Stoody 1 and Stoody 6, have been recently announced by the Stoody Co., Whittier, Calif. Stoody 1—the harder of the two alloys—provides high resistance to abrasion, corrosion, and heat. It is especially recommended for hard-facing pump sleeves, wood saw teeth, carbon scrapers, wire guides, expeller parts, and similar types of equipment.

Stoody 6 is much more ductile and provides greater resistance to impact than Stoody 1, although it is not quite so hard. It is especially useful for hard-facing high-pressure, high-temperature valves, gasoline and Diesel engine exhaust valves, various types of dies, shear blades, cams, etc. 205

To obtain additional information on materials described on this page, see lower part of page 180.

Bakelite Plastics Having a Low Phenolic Content

Several new Bakelite phenolic molding plastics that help to conserve the supply of phenol have recently been announced by the Bakelite Corporation, Unit of Union Carbide and Carbon Corporation, New York City. These materials can be used for many purposes where it is not necessary to meet exacting Government specifications. They include BM-15983 black, BM-16044 brown, and BM-16325 black, developed for uses formerly requiring general-purpose phenolics; and BM-16499, suitable for jobs normally requiring a high-impact resistant material such as BM-3510. 206

Specially Treated Paper Bags Meet Ordnance Container Requirements

The protective wrapping of metal parts and products in accordance with ordnance specifications can now be accomplished with paper bags introduced on the market by E. W. Twitchell, Inc., 42 Public Ledger Bldg., Philadelphia, Pa. The specially treated and laminated paper used in these bags has a high resistance to oil and moisture penetration. Although heavy and strong, this paper is also pliable and conforms readily to angular shapes without tearing. One feature of these bags is that a completely air- and moisture-tight seal can be formed by merely creasing the lip of the opening with a firm finger pressure. The bags are available in a wide range of sizes from those small enough for a single bearing to those large enough for an airplane motor. 207

High-Iron, High-Nickel, Extruded Aluminum Bronze

AMS 4640 extruded bronze, a high-iron, high-nickel aluminum bronze used in aircraft production, has been made available as Grade 45-22 of the Ampcoloy series by Ampco Metal, Inc., 1745 S. 38th St., Milwaukee, Wis. This alloy has a tensile strength ranging from 95,000 to 105,000 pounds per square inch, a yield strength of 50,000 to 55,000 pounds per square inch, and a hardness of 207 to 229 Brinell.....208

Rayon Tow Employed for Mechanical Packing

A special rayon tow is being used in the manufacture of mechanical packing for service against cold and hot water pump rods, plungers, rams, elevator plungers, accumulators, and similar equipment. This tow, manufactured by E. I. du Pont de Nemours & Co., Inc., Wilmington, Del., can be readily impregnated, either before or after braiding, with lubricants formerly employed for flax or hemp. Rayon acts similarly to flax in that it swells when wet, and affords an excellent seal when used as a packing. The individual fibers are continuous in length, eliminating exposed ends. 209

High-Density Resin-Impregnated Plywood

A resin-impregnated plywood with unusual physical properties is now being manufactured by Pluswood, Inc., Oshkosh, Wis. This high-density wood weighs about one-half as much as aluminum, and one-fifth as much as steel. It can be sawed, drilled, turned, threaded, milled, and tapped with metal-working tools.

The veneer used in the manufacture of Pluswood is taken from northern birch and maple logs. After being impregnated with a plastic resin, it is compressed while heated by high-frequency electric waves. The final product has a specific gravity of 1.3 to 1.4 (compared with 0.64 for birch and 0.70 for maple); a tensile strength of from 32,000 to 40,000 pounds per square inch; a compressive strength of 20,000 to 28,000 pounds per square inch when parallel-laminated in the fiber direction; a face compressive strength of 40,000 pounds per square inch when cross-banded; a modulus of rupture in bending of 35,000 to 40,000 pounds per square inch; and an impact strength (Izod) of 6 to 8 pounds per inch of notch.....210

Synthetic Rubber Applicable for Low-Temperature Use

The development of a compound made from the synthetic rubber "Ameripol," which will remain so flexible at minus 70 degrees F. that it can be bent at an angle of 90 degrees around a 1/2-inch rod, has been announced by the B. F. Goodrich Co., Akron, Ohio. The new compound is being used in the construction of bolted tanks that are employed for the storage of high-octane gasoline and aromatic fuels used in military aircraft.

In the construction of these tanks, made from sheet metal, sealing strips of the synthetic rubber, 1 3/4 inches wide by 3/32 inch thick, are placed along the edges where the sheets are bolted together. One-half inch bolts are used to squeeze the synthetic rubber tightly between the plates, thus assuring a fuel-tight seal.....211

To obtain additional information on materials described on this page, see lower part of page 180.

New Trade Literature

RECENT PUBLICATIONS ON MACHINE SHOP EQUIPMENT, UNIT PARTS, AND MATERIALS

To Obtain Copies, Fill in on Form at Bottom of Page 179 the Identifying Number at End of Descriptive Paragraph, or Write Directly to Manufacturer, Mentioning Catalogue Described in the September Number of MACHINERY

Control Equipment

BROWN INSTRUMENT CO., DIVISION OF MINNEAPOLIS-HONEYWELL REGULATOR CO., Wayne and Roberts Aves., Philadelphia, 44, Pa. Bulletin BF-1, on Brown control system for hot-blast temperatures for control of both mixing and cold blast valves. Bulletin HT-S-2, on Brown pyrometer control of high-speed salt baths. 1

Precision Thread-Rolling Machines

W. A. SCHUYLER, 250 W. 57th St., New York, 19, N. Y. Bulletin on the Watson-Flagg precision thread-rolling machine for producing threads on parts used in aircraft, precision machinery, and other products that require accurate threads. 2

Metal-Washing Machines

AMERICAN FOUNDRY EQUIPMENT CO., 555 S. Byrkit St., Mishawaka, Ind. Bulletin 19, on the company's new Tabl-Spray metal-washing machine designed for the high-speed washing of flat fragile work or circular parts with intricate pockets and crevices. 3

Stainless Steels

CARPENTER STEEL CO., 105 Bern St., Reading, Pa. Reference book entitled "Working Data for Stainless Steels—Selection, Engineering, Fabrication," containing in loose-leaf binder form a great deal of specific data on stainless steel and its application. 4

Numbering and Marking Machines

WM. A. FORCE & CO., INC., 216 Nichols Ave., Brooklyn, 8, N. Y. Bulletin on a hand bench press with automatic numbering head for the serial numbering of two or more mating parts. 5

Non-Ferrous Metal Alloys

AMPCO METAL, INC., Milwaukee, Wis. Engineering Data Sheet No. 114, descriptive of non-scratching feed-fingers for screw machines. Engineering Data Sheet No. 115, entitled "Forging Ampco to Improve Physical Characteristics." 6

Die Steel

FIRTH-STERLING STEEL CO., McKeesport, Pa. Circular SL-2014, covering the composition, characteristics, applications, and heat-treatment of HWD hot-work die steel. 7

Lamps for Thread Milling Machines

WALTHAM MACHINE WORKS, Newton St., Waltham, 54, Mass. Circular describing lamp fixtures that can be applied to any Waltham thread milling machine. 8

Cone-Drive Gearing

MICHIGAN TOOL CO., 7171 E. McNichols Road, Detroit, 12, Mich. Instruction manual on how to assemble cone-drive gearing in housings, either for high- or low-volume production. 9

Air-Operated Devices

MEAD SPECIALTIES CO., 15 S. Market St., Chicago, 6, Ill. Catalogue on air-operated devices, including air clamps, work feeders, air vises, and foot controls. 10

Lock-Washers

NATIONAL LOCK WASHER CO., Newark, N. J. Catalogues of steel spring washers, non-ferrous spring washers, non-corrosive coating for spring washers, and retaining rings. 11

Removable Molded-in Inserts

BARDWELL & MCALISTER, INC., 7636 Santa Monica Blvd., Hollywood, 28, Calif. Engineering data sheet showing Rosan one-piece molded-in inserts and method of removal for replacement. 12

Electronics

GENERAL ELECTRIC CO., Schenectady, N. Y. Bulletin GED-1068, "A Primer of Electronics." Non-technical book (24 pages) entitled "How Electronic Tubes Work." 13

Use of Gage-Blocks

GEORGE SCHERR CO., 126 Lafayette St., New York, 13, N. Y. Folder entitled "The Use of Gage-Blocks," for inspection departments and machine shops. 14

Automatics for Polishing or Buffing

HAMMOND MACHINERY BUILDERS, INC., Kalamazoo, Mich. Bulletin 401, on rotary automatics for burring, brushing, polishing, or buffing. 15

Colloidal Graphite

ACHESON COLLOIDS CORPORATION, Port Huron, Mich. Bulletin 431-YY, entitled "Colloidal Graphite for Impregnation and Surface Coatings." 16

Induction Heating Equipment

ELECTRIC ARC, INC., 218 Jelliff Ave., Newark, 8, N. J. Catalogue entitled "Preheating, Welding, and Normalizing by the Induction Method." 17

Hydraulic Equipment

DENISON ENGINEERING CO., 1152 Dublin Road, Columbus, Ohio. Bulletin M-19, illustrating and describing hydraulic presses, valves, and other hydraulic equipment. 18

Cutting Tools

ILLINOIS TOOL WORKS, 2501 N. Keeler Ave., Chicago, Ill. Bulletin entitled "Illinois Design — the Expression of Ingenuity plus Experience." 19

Arc-Welding Accessories

GENERAL ELECTRIC CO., Schenectady, N. Y. Bulletin GEA-2704C, illustrating and describing a complete line of arc-welding accessories. 20

Tapping and Tapping Machines

CLEVELAND TAPPING MACHINE CO., 1725 Superior Ave., Cleveland, Ohio. "Guide for Production Tapping." 21

Diamond Tool Wheel Truing

WHEEL TRUEING TOOL CO., INC., 3200 W. Davison Ave., Detroit, 6, Mich. Catalogue entitled "Tru-Line Engineered Diamond Tools." 22

Diamond Tools

CLEVELAND INDUSTRIAL TOOL CORPORATION, 4713 Euclid Ave., Cleveland, Ohio. Catalogue on diamond-tipped tools for machining and wheel dressing. 23

Carbide Die Servicing

CARBOLOY COMPANY, INC., Detroit, 32, Mich. Booklet D-115, outlining free training courses in carbide die servicing. 24

Electronic Devices

WESTINGHOUSE ELECTRIC & MFG. CO., East Pittsburgh, Pa. Booklet B-3264, entitled "Electronics at Work." 25

Production Equipment

DAVID J. ROSS CO., Benton Harbor, Mich. Catalogue on punch presses, precision vises, and adjustable milling spacers. 26

Thread-Tool Grinding Fixtures

H. C. WILSON, Huntington Park, Calif. Bulletin on thread-tool grinding fixtures for rapid and accurate grinding. 27

Furnaces

HEVI DUTY ELECTRIC CO., Milwaukee, Wis. Bulletin HD-643, entitled "Protective Combusted Atmospheres in Hevi Duty Furnaces." 28

Carburizing Baths

A. F. HOLDEN CO., New Haven, Conn. Bulletin on liquid carburizing baths for temperatures from 1450 to 1750 degrees F. 29

Molded and Extruded Plastics

ELMER E. MILLS CORPORATION, 812 W. Van Buren St., Chicago, Ill. Catalogue III, on injection molded and extruded plastics. 30

Tap Grinders

EDWARD BLAKE CO., 634 Commonwealth Ave., Newton Centre, Mass. Bulletin 5, on Blake No. 1 and No. 2 tap grinders. 31

Lubricating Systems

FARVAL CORPORATION, 3293 E. 80th St., Cleveland, 4, Ohio. Booklet 15, "The Multival Lubricating System." 32

Collapsible Taps

MURCHEY MACHINE & TOOL CO., Detroit, 26, Mich. Catalogue descriptive of Type BM collapsible machine taps. 33

Polishing and Buffing

DIVINE BROTHERS CO., Utica, N. Y. Pocket-size table of polishing and buffing wheel speeds. 34

Crane Maintenance

HARNISCHFEGER CORPORATION, Milwaukee, Wis. Booklet entitled "P & H Crane Trouble Shooter." 35

Surface Plates

BARCO SCRAPING CO., 1975 E. 65th St., Cleveland, Ohio. Bulletin on Meehanite surface plates. 36

Turning Rolls

RANSOME MACHINERY CO., Dunellen, N. J. Bulletin 188, on turning rolls. 37

Thread-Tool Grinding Fixture

ROBERT H. CLARK CO., 3424 Sunset Blvd., Los Angeles, 26, Calif.

To Obtain Copies of New Trade Literature

listed on pages 178-180 (without charge or obligation), fill in below the publications wanted, using the identifying number at the end of each descriptive paragraph; detach and mail to:

MACHINERY, 148 Lafayette St., New York, 13, N. Y.

No.	No.	No.	No.	No.	No.	No.	No.	No.	No.

Name ..... *Position or Title* .....

[This service is for those in charge of shop and engineering work in manufacturing plants.]

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Business Address .....

City ..... *State* .....

[SEE OTHER SIDE]

Circular on a new thread tool grinding fixture for 60- and 29-degree tools. 38

Turret Punch Presses

WIEDEMANN MACHINE CO., 1807 Sedgley Ave., Philadelphia, Pa. Bulletin 24, descriptive of hand-operated turret punch presses. 39

Pipe Couplings and Fittings

DRESSER MFG. CO., Bradford, Pa. Catalogue showing pipe couplings and fittings and other ring-shaped work. 40

Recording Thermometers

BRISTOL CO., Waterbury, Conn. Bulletin T800, on recording thermometers for industrial use. 41

Zinc Products for War Work

NEW JERSEY ZINC CO., 160 Front St., New York, 7, N. Y. Bulletin entitled "Zinc in War." 42

Tool Steels

COPPERWELD STEEL CO., Warren, Ohio. 48-page loose-leaf "Handbook of Coppco Tool Steels." 43

Piping

FLORI PIPE CO., St. Louis, Mo. Catalogue entitled "If It's Piping, Contact Flori." 44

Drill Presses

BOICE-CRANE CO., 959 Central Ave., Toledo, Ohio. Catalogue on Boice-Crane 15-inch drill presses.45

Present-Day Solders Require New Technique

Since the solder used today differs considerably from pre-war solder, the soldering technique must also differ. Solder formerly was composed of approximately 50 per cent tin and 50 per cent lead; now, because of the scarcity of tin, solder seldom contains more than 20 per cent tin. The present solder requires a hotter soldering iron, and attention must be given to certain details. The metallurgy committee of the General Electric Co. gives these rules:

1. Keep your work clean. Guard carefully against varnish, grease, oil, dirt, rust, or corrosion products. They prevent the flux from acting and the solder from alloying with the parent metal.

2. Keep in mind that the purpose of the soldering iron or torch is not to melt the solder, but to heat the work until the solder will flow when applied to the work.

3. Keep the soldering iron clean, and to have the quickest possible heat transfer from the iron to the work, have the tip designed actually to fit against the work.

4. Investigate different methods available for doing the work—hotter electric iron, high frequency, or carbon resistance soldering tools may do the job better.

5. Design your joints so as to have 0.003 to 0.005 inch solder thickness, and so that the two parts overlap. Lap or seam type joints are better than butt type joints. Have the solder fill the seam completely. Heavy fillets add little strength to the joint and waste solder.

6. Don't hand a new solder, a flux, and a soldering job to a workman and expect a perfect job the first time. Let him get the "feel" of the new material. Don't give up a new solder after one unsuccessful trial—the chances are that your technique is not what it should be for that particular solder.

* * *

Aid to Plating Departments and Finishing Shops

Bright zinc-plating is now being used in place of the increasingly scarce cadmium for the finishing of many types of ordnance and other war supplies. This requires proper surface preparation before the application of the protective zinc coatings. Oakite Products, Inc., 26 Thames St., New York, 6, N. Y., has made available to industry a special service report that describes in detail successfully used metal-degreasing methods and outlines procedures by which this work can be done on a faster and more efficient basis than formerly. The report reviews concisely still tank and cathodic cleaning, as well as anodic degreasing for removing dirt, grease, quenching and cutting oils, drawing and stamping compounds, etc. It also includes data on presoaking methods that aid in securing chemically clean surfaces.

To Obtain Additional Information on Shop Equipment

Which of the new or improved equipment described on pages 181-204 is likely to prove advantageous in your shop? To obtain additional information or catalogues about such equipment, fill in below the identifying number found at the end of each description—or write directly to the manufacturer, mentioning machine as described in September, 1943, MACHINERY.

No.	No.	No.	No.	No.	No.	No.	No.	No.	No.

Fill in your name and address on other side of this blank.

To Obtain Additional Information on Materials of Industry

To obtain additional information about any of the materials described on pages 176-177, fill in below the identifying number found at the end of each description—or write directly to the manufacturer, mentioning name of material as described in September, 1943, MACHINERY.

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Detach and mail to MACHINERY, 148 Lafayette St., New York, 13, N. Y.

[SEE OTHER SIDE]

Shop Equipment News

Machine Tools, Unit Mechanisms, Machine Parts, and Material-Handling Appliances Recently Placed on the Market

Libby Heavy-Duty Turret Lathes

A new line of Type H heavy-duty turret lathes has been developed by the International Machine Tool Corporation, Libby Division, 1128 W. 21st St., Indianapolis, Ind. The line includes the regular heavy-duty turret lathes and the fixed-bed and sliding-bed types. Five sizes of the regular heavy-duty turret lathes are built. The fixed-bed gap machines are built in five sizes, and the sliding-bed gap machines in three sizes.

The bed and headstock are cast in one piece. Wide and flat hardened steel ways are dovetailed into the bed casting by a special construction requiring no bolts or screws.

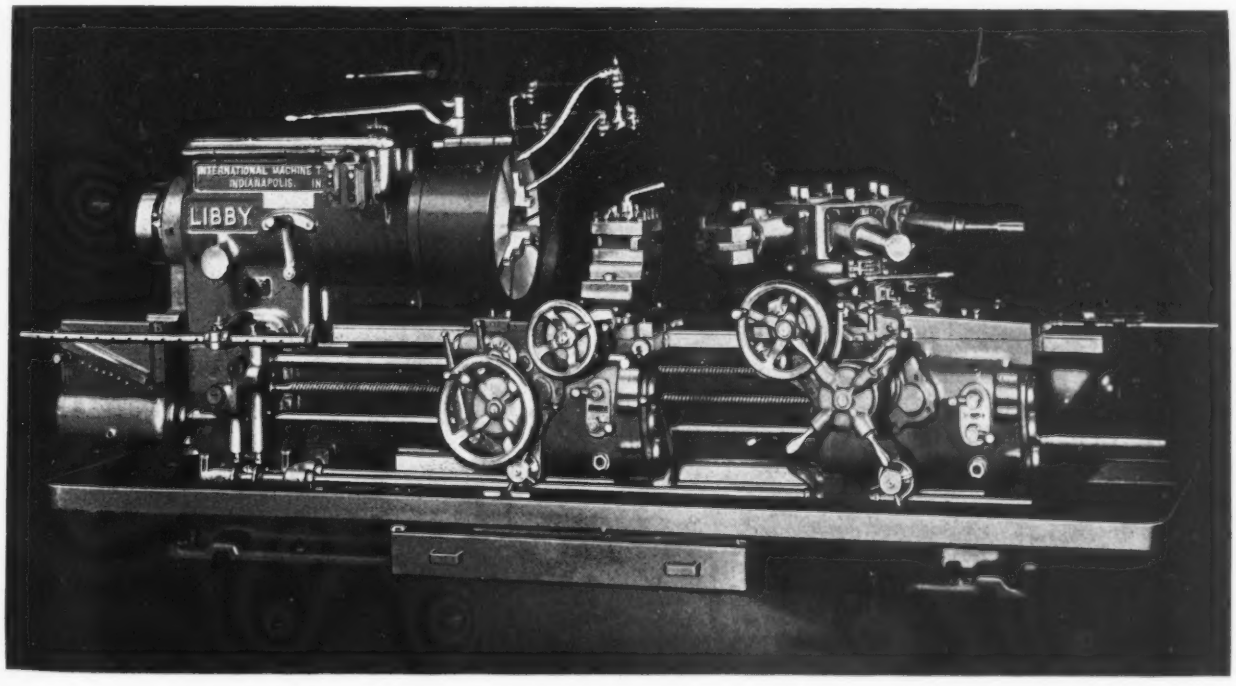
Motors of from 10 to 50 H.P. are provided, according to the size of the machine. The regular headstock transmission provides eight spindle speeds, but sixteen speeds are obtainable through a two-speed motor. The feeds in the apron are of the rapid-traverse type, and are independent of each other. Eight reversible feeds are provided in the apron for each of the nine positions of the lever on the selective gear-box, making a total of seventy-two feed changes ranging from 0.007 to 0.500 inch. This provides the required feeds for cutting all standard threads from 2 to 128, including 7 1/2 and 11 1/2 threads per inch. A special feed range of from 0.0019 to 0.125 inch may be furnished.

The feed changes are obtained by rotating the dial on the lower left-hand side of the apron and by shifting the clutch lever to the left or right for coarse or fine feed. Longitudinal power feed is obtained by locking the handwheel, which causes the lead-screw nut to revolve about the lead-screw. This provides a steady smooth feed.

The cross-feed is operated through a friction clutch, and is engaged by a lever on the apron. It is disengaged manually by pulling a knurled top plunger on the lever. Adjustable stops are provided for automatically disengaging the feed for duplicating dimensions.

The square turret is positioned by a locating pin, and may be set in eight different positions. The fixed-center hexagon turret is furnished for high production, and permits the use of multiple tooling set-ups. The cross-sliding hexagon turret handles a wide variety of work in small lots when required. Instead of having multiple toolholders, it carries single-cutter boring-bars and forged tools of simple design.

A combination splash and automatic force-feed lubricating system is provided. The coolant system is built into the machine. 51



Libby Heavy-duty Turret Lathe Developed by the International Machine Tool Corporation

To obtain additional information on equipment described on this page, see lower part of page 180.

Sheffield Thread-Grinders with Single- or Multi-Ribbed Wheels

The Sheffield Corporation, Dayton, Ohio, has developed a thread-grinder on which either the conventional single-ribbed wheel or a multi-ribbed wheel can be employed. This new thread-grinding machine can be used for precision gage work or for straight commercial production.

These thread-grinders produce single or multiple right- or left-hand threads with any pitch up to 60 threads per inch. The maximum length of work held between centers is 12 inches; the maximum thread length that can be ground is 8 inches. The grinder accommodates work having a maximum diameter of 7 inches, and grinds threads up to a maximum diameter of 3 inches. Any type of thread form can be ground with wheels properly shaped.

Either traverse grinding or plunge cutting can be employed. In the latter operation, a multi-ribbed wheel sufficiently wide to equal the thread length is fed in to the full depth of the thread, and the thread is formed in one pass, with the stock making approximately 1 1/3 to 1 1/2 turns. Multiple threads—with two, three, or four starts—can in most cases be ground in one pass, thus eliminating the necessity for precision indexing.

An important feature of the machine is the multi-ribbed wheel crusher, which is forced into the slowly rotating grinding wheel to accurately form the wheel ribs.

Some models of this thread-grinder are equipped for automatic cycle grinding. After the initial manual set-up for producing the first piece, the operator is required only to load and unload, and to throw one lever to start the repeating cycle. 52

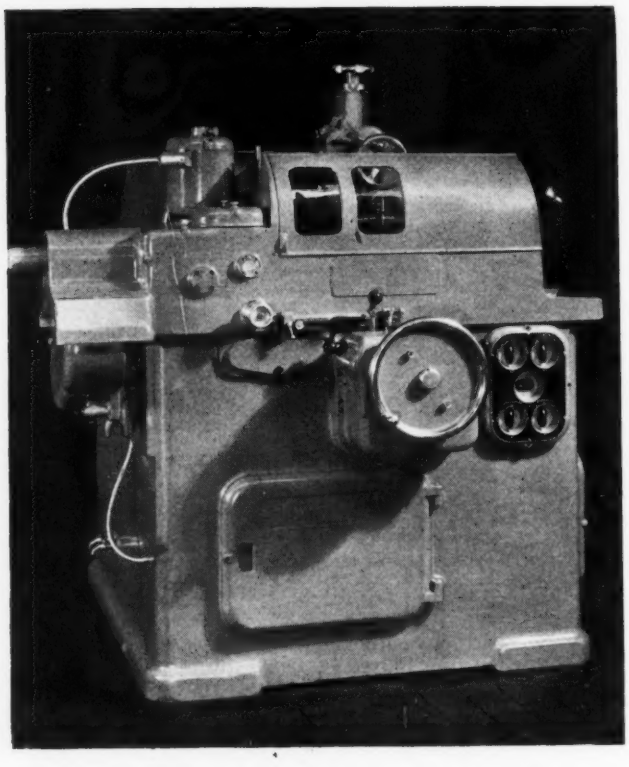
Watson-Flagg Precision Thread-Rolling Machine

A thread-rolling machine that forms outside threads by the cold-forming process, using two steel rolls of large diameter which have on their cylindrical surfaces multiple threads of the same profile, pitch, and helix angle as the thread to be rolled, is manufactured by the Watson-Flagg Machine Co., Inc., Paterson, N. J. The exclusive selling agent is W. A. Schuyler, 250 W. 57th St., New York, 19, N. Y.

The thread-forming rolls are pressed with gradually increasing hydraulic pressure into the blank which has been machined to the pitch diameter required. The full length of the thread is rolled at one time. The blank, resting on a support between the rotating rolls, turns on its axis, but does not move lengthwise. An automatic sizing control, set by micrometer adjustment, releases the hydraulic pressure on the rolls when the thread is completed, and then automatically returns the carriage-mounted roll to its starting position. Thus all threads are rolled precisely alike.

The rolling pressure and the speed of the rolls to suit different metals, the pitch, and the diameter of the thread to be rolled, are easily adjusted. The rolling pressure compresses the metal in the thread, thereby increasing its strength; at the same time, it burnishes the thread surfaces to a mirror-like polish.

It is stated that the machine will produce .Class 4 fit accuracy on bolts, studs, and screws made from



Sheffield Thread-grinder that Employs either a Single- or a Multi-ribbed Wheel

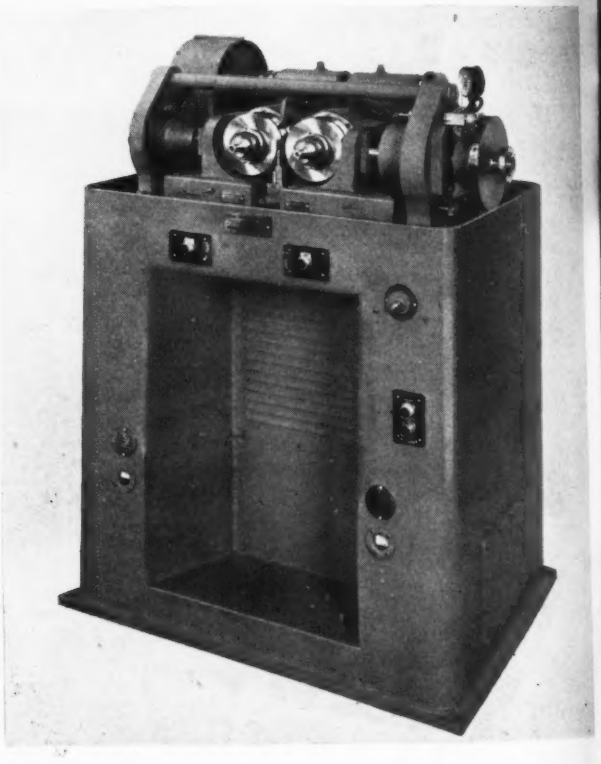
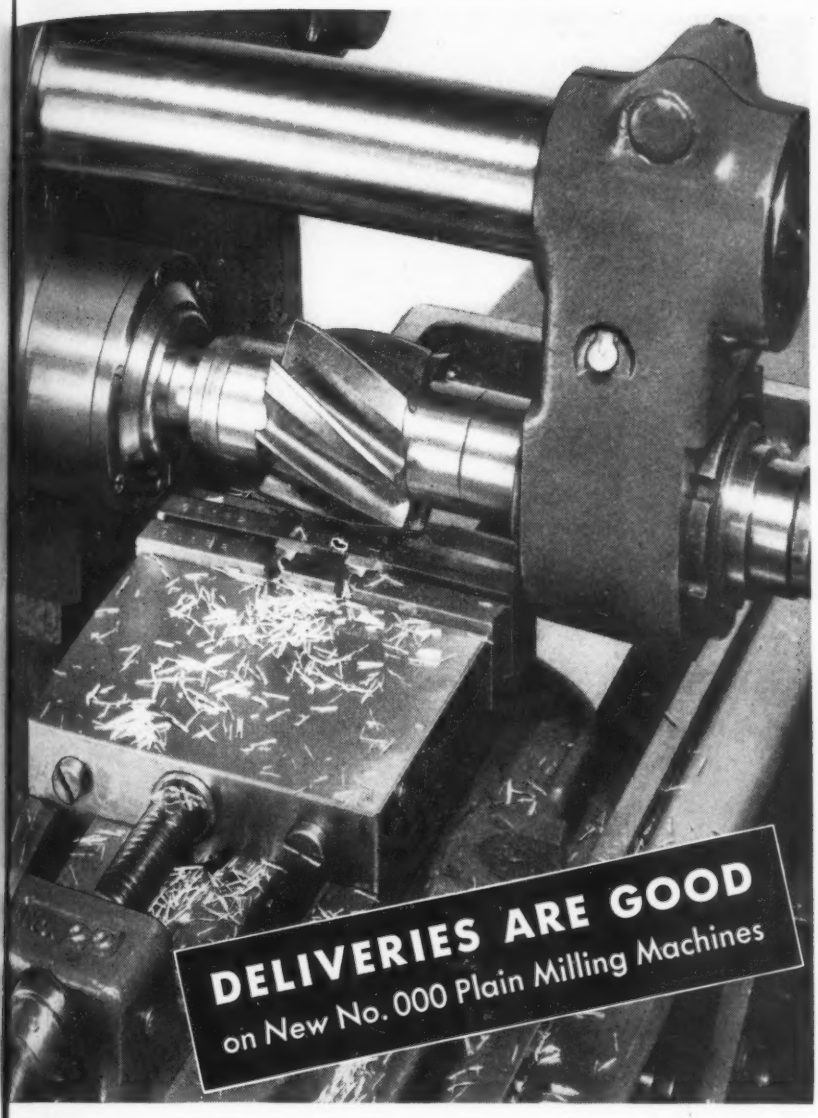


Fig. 1. Precision Thread-rolling Machine Built by the Watson-Flagg Machine Co.

To obtain additional information on equipment described on this page, see lower part of page 180.

KEEP NON-CUTTING TIME AT A MINIMUM ON YOUR Nº 000 PLAIN MILLING MACHINE



Careful set-up minimizes length of operating cycle

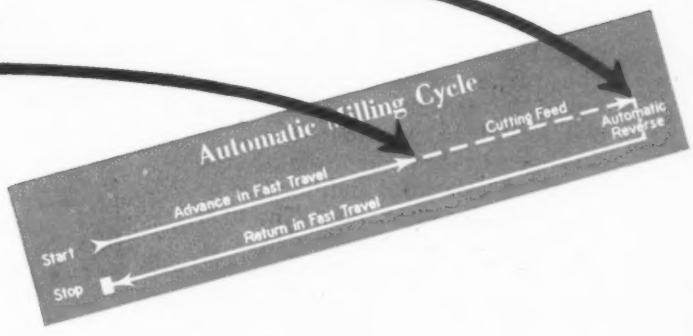
—a waste of even two or three seconds represents a considerable percentage increase on a short cut

The No. 000's accuracy of feed engagement and table reversal allows close setting—and the 3/8" minimum length of cutting feed permits milling short cuts ***efficiently***.

On any job —

1—Locate the work so cut will be completed just at point of table reversal

2—Set the table dog to bring the work up close to the cutter at fast travel



We are proud to be honored with the Navy "E", awarded for outstanding accomplishment in Defense production.
Brown & Sharpe Mfg. Co.
Providence, R. I., U. S. A.

Make **full** use of the production possibilities of the No. 000 Plain Milling Machine for the rapid milling of small parts on a wide variety of materials.

BROWN & SHARPE

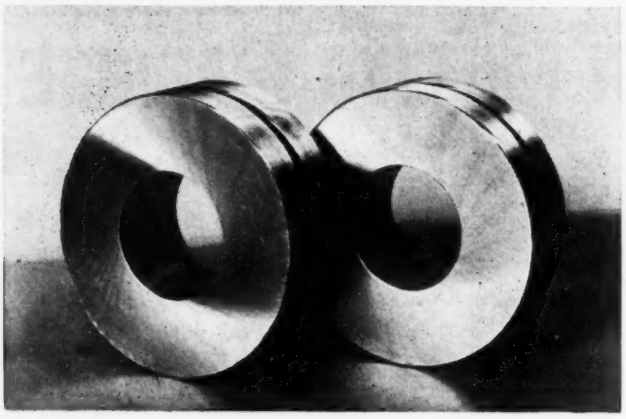
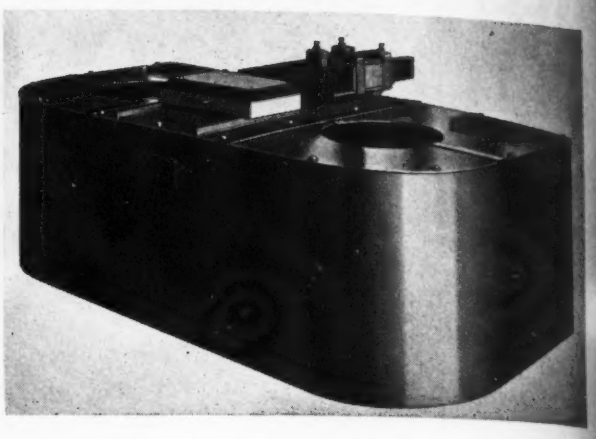


Fig. 2. Thread-forming Rolls Used in Thread-rolling Machine



Heat-treating Unit Brought out by the A. F. Holden Co.

high-strength steels used in aircraft and for other precision purposes. Accurate threads can also be rolled on light metals, hollow bodies, tubes, shafts, or spindles. Adjustment is provided for one of the rolls, so that tapered threads can be rolled.

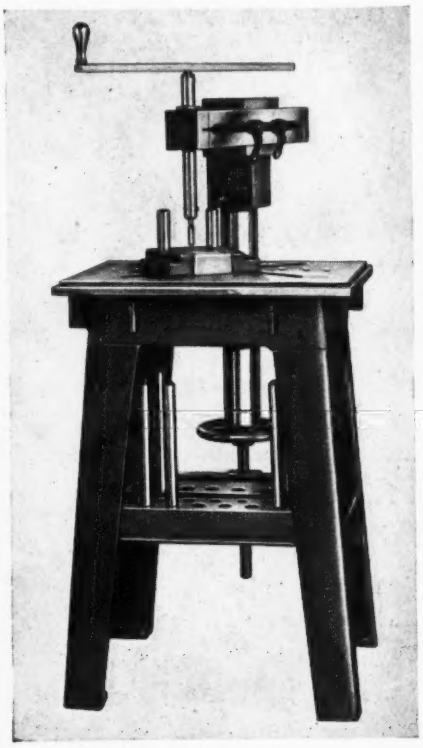
The capacity of the machine depends on the metal to be threaded. High tensile-strength steels up to 1 inch in diameter can be rolled, while diameters up to 4 1/2 inches can be handled in softer materials. The length of the thread may be up to 2 3/4 inches.....53

Producto Universal Hand Tapping Machine

A heavy-duty, general-purpose, hand tapping machine has been placed on the market by the Producto Corporation, 3017 Medbury Ave., Detroit, Mich. This machine is designed to insure the production of accurately tapped holes and to prevent tap breakage. No setting-up operations are required, and the machine is always ready for use.

The table is drilled and tapped to facilitate clamping the work, and is also drilled at four points to accommodate a tapered stop-pin for locating work that does not require clamping. There are four slots radiating from the center of the table which facilitate the disposal of chips.

The sliding arm is movable longitudinally and radially, and can be locked in any position for tapping holes in work on the table. The vertical column can be adjusted by means of a handwheel and locked in position; thus the arm can be brought close to the work for accurate hand-tapping or hand-reaming operations. The arm is designed to receive two sizes of spindles by employing a slip bushing. A spindle 1 inch in diameter, used with the slip bushing, takes taps ranging from No. 5 to 3/4 inch in diameter. By removing the slip bushing, a spindle 1 1/4 inches in diameter can be used, which takes taps from 13/16 to 1 inch in diameter.....54



Hand Tapping Machine Made by Producto Corporation

Holden High-Speed Heat-Treating Unit

A Type 230 high-speed heat-treating unit consisting primarily of three pots operated at different temperatures has been placed on the market by the A. F. Holden Co., New Haven, Conn. Pot No. 1, which has a temperature range of 1400 to 1800 degrees F., is intended for preheating high-speed steel tools, for heating water-hardening, oil-hardening, and alloy steels, and for silver soldering.

Pot No. 2 has a temperature range of 1900 to 2350 degrees F., and is intended for hardening all types of high-speed steels, for copper brazing, and for heat-treating forgings. Pot No. 3 has a temperature range of 1000 to 1400 degrees F., and is intended for quenching high-speed steel tools from the hardening temperatures, for tempering, for nitriding, for bluing, and for descaling forgings and similar parts. Pots Nos. 1 and 3 are interchangeable, so that several different baths can be used in the same furnace unit.....55

Prosser Heavy-Duty Carbide-Tool Grinder

An improved, heavy-duty, carbide-tool grinder known as Model EE, to be used for either wet or dry grinding, has been placed on the market by Thomas Prosser & Son, 120 Wall St., New York, 5, N. Y. The machine embodies all the features of the line of carbide grinders previously built by this company, but has been completely redesigned with a massive base,

To obtain additional information on equipment described on this page, see lower part of page 185

THE CINCINNATI SHAPER CO.

CINCINNATI OHIO U.S.A.

SHAPERS BRAKES SHEARS

Shaping a 10,000 lb. Plate

The Shaper is recognized as indispensable in the toolroom—but many manufacturing jobs are best performed on Shapers. Whether shaping slots in a 10,000-lb. plate or contouring small parts, the power and accuracy of Cincinnati Shapers will meet your requirements.

Write for Calalog N-2

improved wet grinding equipment, and improved method of motor mounting. The wet grinding equipment consists of a coolant pump, pan, settling tank, piping, and nozzles, providing a copious flow of water. Various attachments are also available, such as a drill grinding attachment and a diamond wheel-dresser. 56

Fitchburg Automatic Precision Grinders

The Fitchburg Grinding Machine Corporation, Fitchburg, Mass., has brought out two new types of plain cylindrical automatic precision grinders—the Type B 6-inch and Type B 10-inch. New features are incorporated in these grinders to obtain greater accuracy, finer finish, increased production, and more economical operation.

The B 6-inch plain cylindrical grinder, shown in Fig. 1, permits both small lots or continuous repetitive work to be handled efficiently. This machine can be easily moved from one department to another.

The unique spring tension method of feeding the wheel eliminates feed-screws, bearings, and joints, so that there is no backlash. This feeding method provides the sensitivity required for maintaining accuracy to 0.0001 inch. The automatic cross-feed consists of a continuous in-feed which can be used for plunge-cut grinding or table traverse work. The variable-speed control provides for increasing or decreasing the table speeds in stepless adjustments from zero to the maximum speed.

The normal swing over the table is 6 inches, and the maximum swing 9 inches. The machine is made in two center-distance capacities, taking 19 1/4 and 31 1/2 inches between centers. The stepless table speeds range from 28 to 188 inches per minute, and the work speeds from 136 to 580 R.P.M.

The Type B 10-inch grinder, shown in Fig. 2, is designed to handle a wide range of work. This machine is equipped with a fixed standard "Bowgage" wheel-head unit which operates through a completely automatic cycle consisting of rapid traverse to the work, correct feed, grinding dwell, and rapid return. Feed movements can be controlled within limits of 0.0001 inch by the wheel-feed dial.

The normal swing over the table of this machine is 10 inches, and the maximum swing 13 1/2 inches. The machine will take work up to 24 1/2 inches between centers. The maximum diameter that can be ground using a 24-inch wheel is 6 inches, and with a 20-inch wheel, 10 inches. The work speed has a stepless adjustment from 106 to 425 R.P.M. 57

Ferracute Foot-operated Press for Forming, Cutting, Piercing, and Other Light Operations

Ferracute Press

A foot-operated press (the F02), designed for forming, cutting, piercing, riveting, stamping, and other light operations, has been brought out by the Ferracute Machine Co., Bridgeton, N. J. A kick of the pendulum lever serves to operate the ram, which is returned to its initial position by the weight of the lever. The press is furnished either for bench mounting or with a cast pedestal as shown.

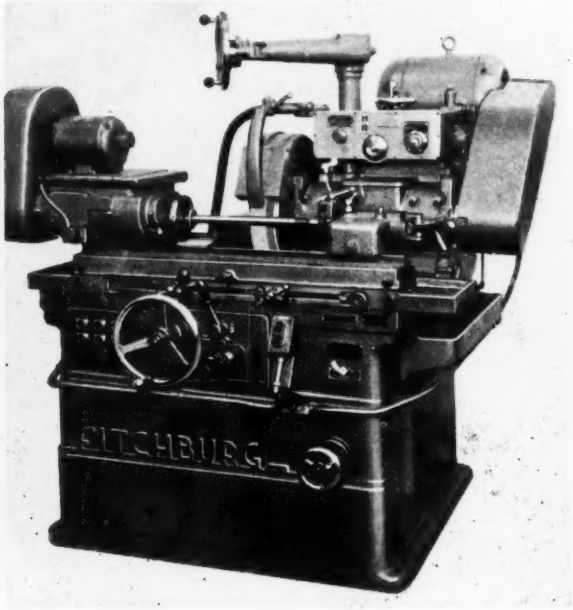


Fig. 1. Fitchburg Type B 6-inch Automatic Precision Grinder

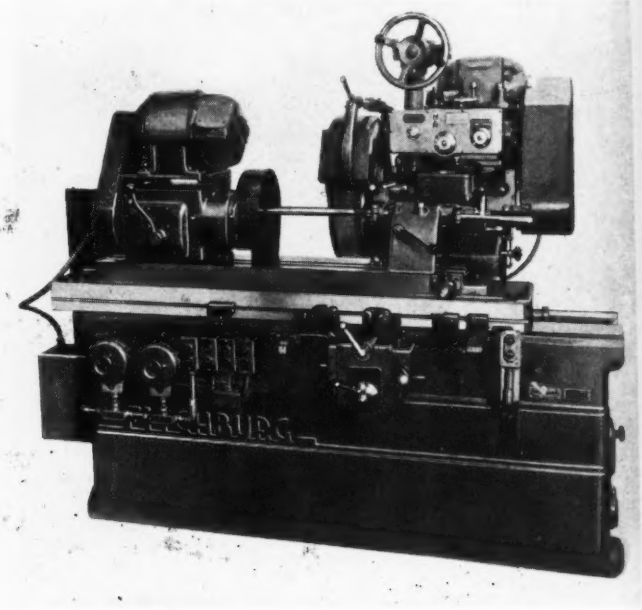
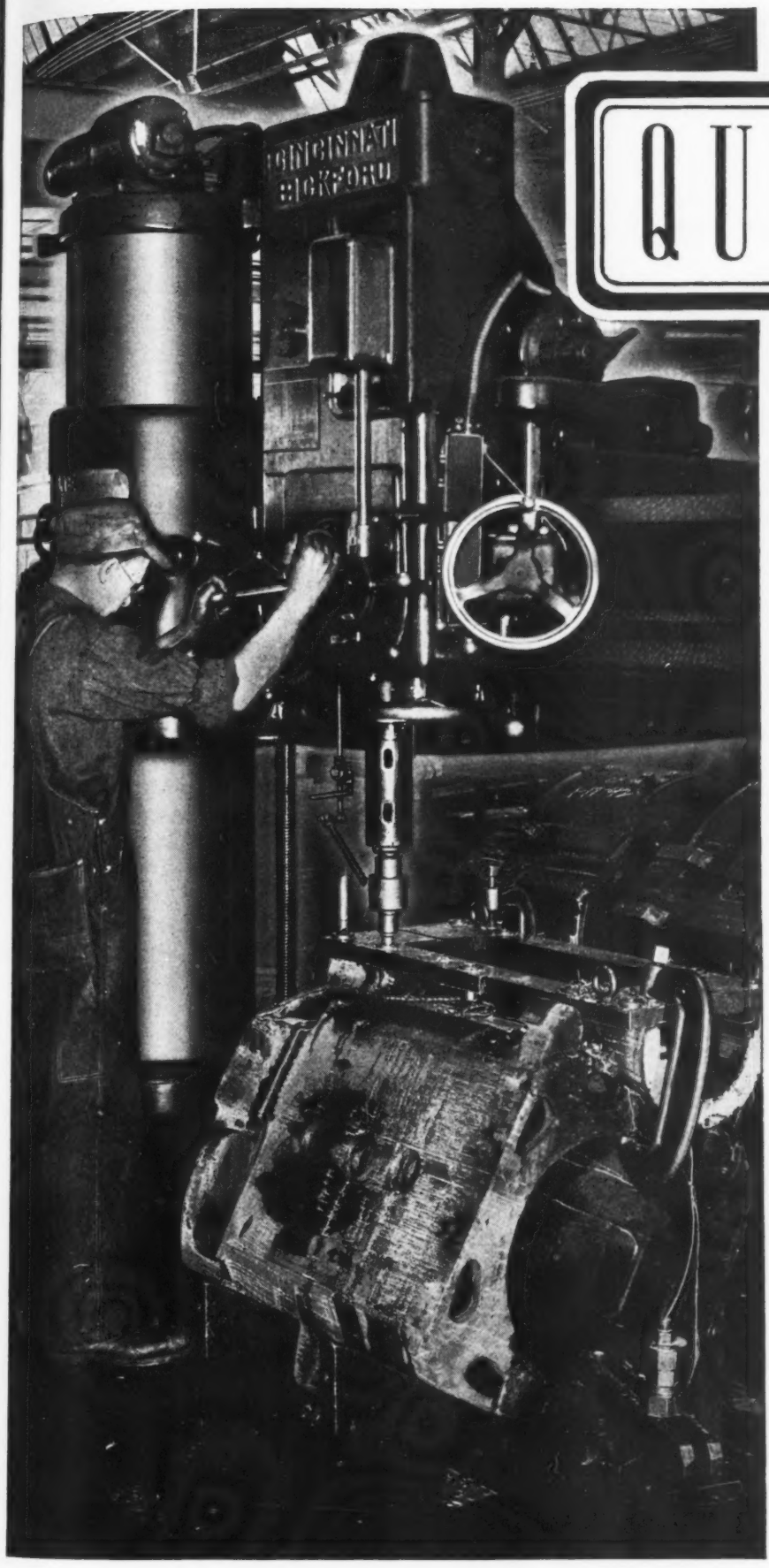


Fig. 2. Fitchburg Type B 10-inch Automatic Precision Grinder

To obtain additional information on equipment described on this page, see lower part of page 180.



QUALITY

YOUR ONE SOLID ASSURANCE OF SPEED AND ACCURACY FOR WAR PRODUCTION

Illustrated is a typical application of the SUPER SERVICE RADIAL to wartime production. The job calls for operations on motor frames for Diesel-electric switcher-engines . . . vital jobs, because the War Department, the Navy Department, Arsenals and many large manufacturers require these engines to speed essential transportation. For work of this character the SUPER SERVICE RADIAL is almost a standard. You'll find these famous Radials on the job, 3-shifts-per-day, 7 days a week, in countless war production plants from coast to coast. The Quality of their design —the Quality of their workmanship and construction — the Quality of their performance is such that the name "Cincinnati Bickford" on a Radial is sufficient to assure top operating speeds, unexcelled accuracy and "more holes per dollar."

THE CINCINNATI BICKFORD TOOL CO. OAKLEY, CINCINNATI, OHIO, U. S. A.

The pressure exerted by the ram at a point near the bottom of the stroke is two tons. The stroke of the ram ranges from 0 to 1 1/2 inches, and the distance from the center of the ram to the frame is 4 1/2 inches. The maximum height from the bed to the ram is 5 1/4 inches. There is a 3-inch hole through the center of the bed. The bench press weighs 200, and the pedestal type 300 pounds. 58

Tocco Junior Induction Heating Machine

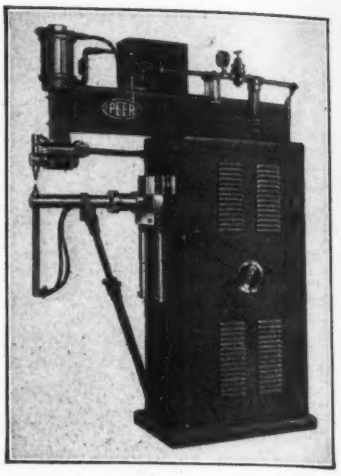
A new highly flexible Tocco Junior induction heating machine with an output capacity of 15 kilowatts has been brought out by the Ohio Crankshaft Co., 3800 Harvard Ave., Cleveland, 1, Ohio. This is a small, compact 9600-cycle high-frequency unit, and is the seventh of the line of Tocco Junior induction heating machines. It is suited to a wide range of induction heating applications, being adapted to brazing, annealing, heat-treating, and heating for forging and surface hardening of small and medium-sized parts. A 20-H.P. motor-generator maintains accuracy of heat control under all operating conditions.

The new machine is especially adapted for the brazing of small parts such as carbide tips, where fast controlled heating is needed. Tube fittings, shell adapters, burster tubes, and many other small parts can be handled on this machine. It is available with one or two working stations. This machine occupies a floor space of 48 by 32 inches, and stands 51 inches high, with the work pan set 35 inches above the floor. Only three connections are needed, two for water and one for the 220- to 440-volt electric line. 59

Automatic High-Speed Spot-Welder

New P-20 automatic press type spot-welders designed to meet present-day high-speed production requirements are being made by the Pier Equipment Mfg. Co., Benton Harbor, Mich. Control of pressure, welding time, holding time, off time, and speed up to 110 strokes per minute is accomplished automatically, practically no effort being necessary to operate the welder. Provision is made for variations in the cycle to suit each welding job.

The upper electrode is operated by a double-acting air cylinder. The electrode pressure range can be adjusted by regulating an air pressure valve. The electric current can be adjusted from 50 per cent of the maximum to 100 per cent by means of an eight-point selector switch. This welder is made in 20 and 30 kilovolt-ampere capacities. It can be furnished with a throat depth of either 12 or 24 inches. 60

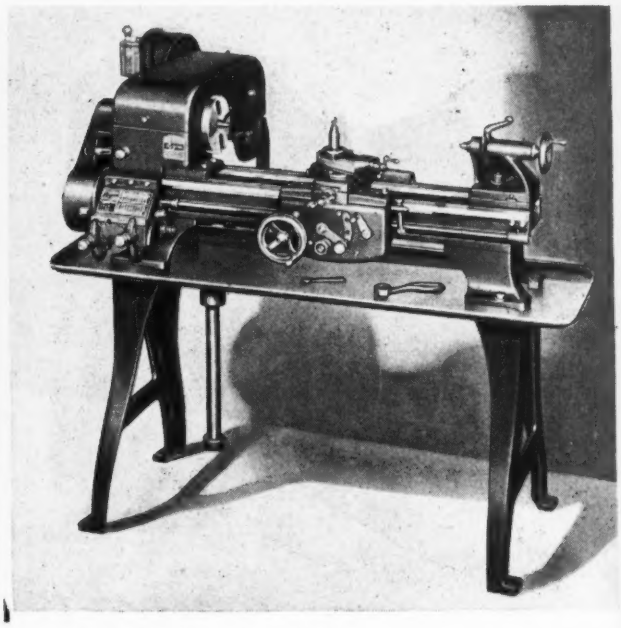


"Peer" Automatic High-speed Spot-welder

Logan Quick-Change Gear Lathe

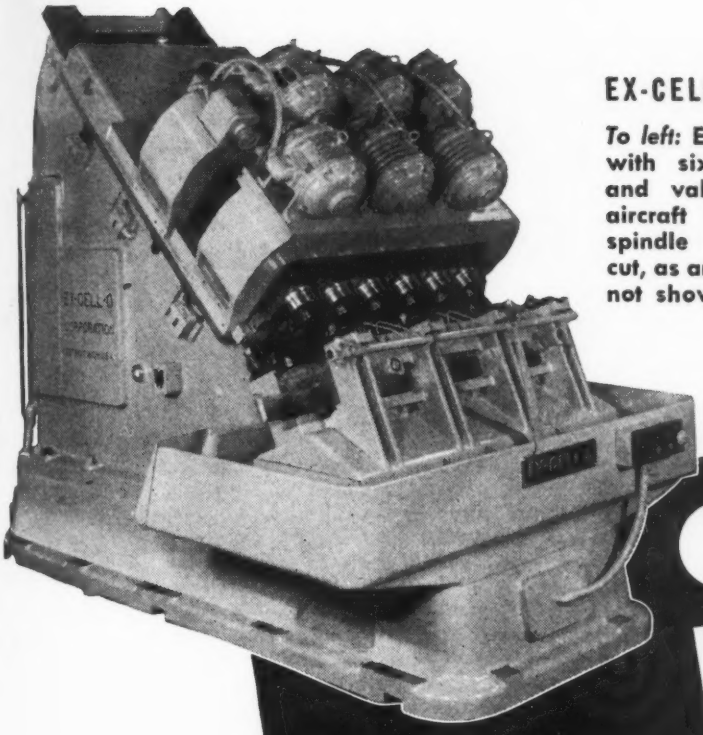
The Logan Engineering Co., 4901 Lawrence Ave., Chicago, Ill., has placed on the market a quick-change gear lathe especially designed for use where frequent changes in operating feeds must be

Tocco Junior Induction Heating Machine for Small and Medium-sized Parts



Quick-change Gear Lathe Brought out by the Logan Engineering Co.

To obtain additional information on equipment described on this page, see lower part of page 180.



EX-CELL-O CYLINDER BORING MACHINE

To left: **Ex-Cell-O angular type machine equipped with six spindles to finish bore valve seats and valve guide holes in cylinder head of aircraft engine on a production basis. Each spindle is individually adjustable for depth of cut, as are the tools in the boring bars (boring bars, not shown in picture, are piloted in the fixture).**

SPECIAL MACHINES

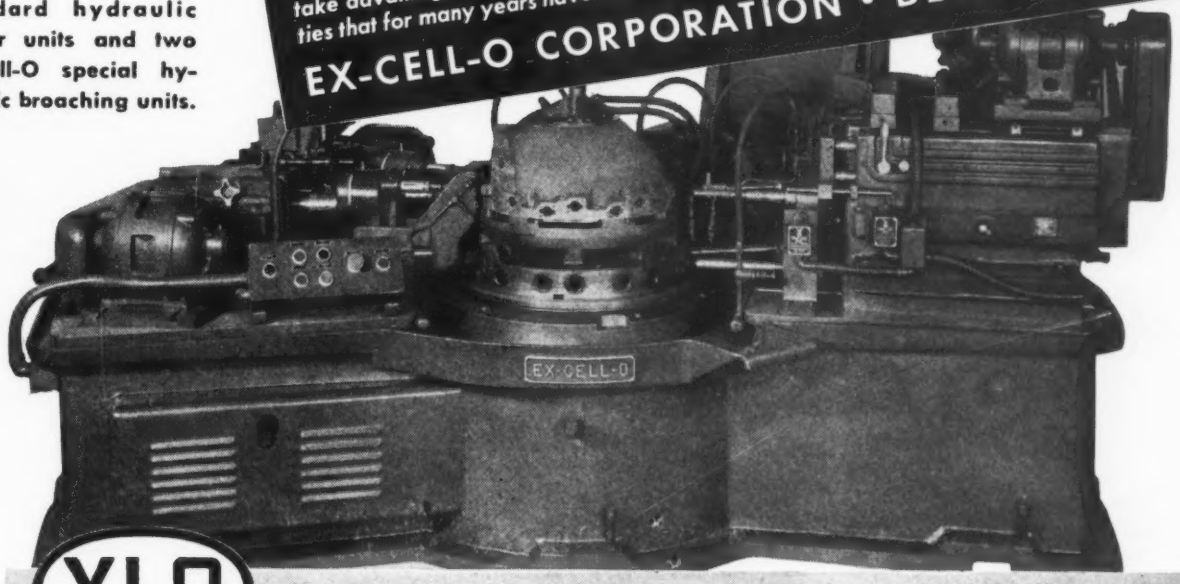
. . . for today's production . . . and tomorrow's

For years Ex-Cell-O has been familiarly known as "the headquarters" for special single-purpose machines for turning out accurate parts at a high rate of speed . . . machines that frequently perform numerous operations in one setting of the work and often bring not only a substantial increase in the number of parts produced hourly but also improved quality and reduced unit cost. . . . This is why so many manufacturers have turned to Ex-Cell-O for equipment to meet their war production schedules; why Ex-Cell-O designed machines will figure in the post-war plans of an increasing number of American industries. . . . If you are planning for tomorrow, when the new standards will necessitate costs that are competitive, take advantage of the wide engineering experience and extensive manufacturing facilities that for many years have made Ex-Cell-O a leader in the precision machine tool field.

EX-CELL-O CORPORATION • DETROIT, MICH.

EX-CELL-O SIX-WAY MACHINE

Below: **Ex-Cell-O six-way machine for drilling, broaching and reaming valve guide holes in a magnesium crankcase. This machine is equipped with four standard hydraulic power units and two Ex-Cell-O special hydraulic broaching units.**



XLO

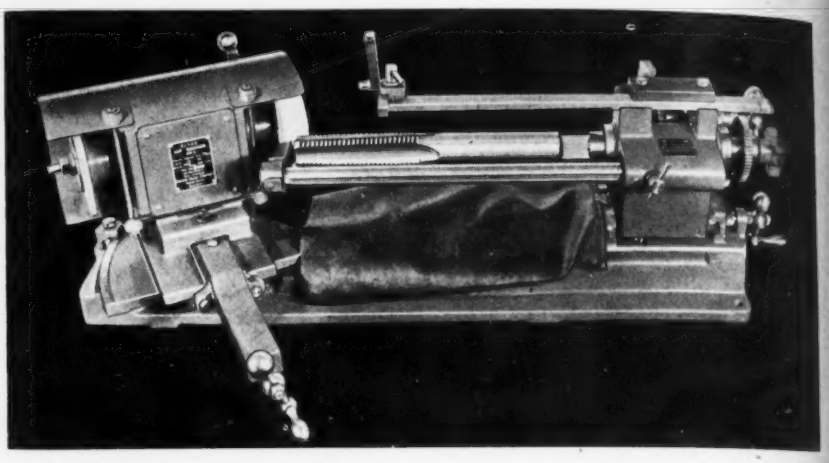
EX-CELL-O *for* PRECISION

Precision **THREAD GRINDING, BORING AND LAPPING MACHINES • TOOL GRINDERS • HYDRAULIC POWER UNITS • GRINDING SPINDLES • BROACHES • CONTINENTAL CUTTING TOOLS • DRILL JIG BUSHINGS • DIESEL FUEL INJECTION EQUIPMENT PURE-PAK CONTAINER MACHINES • R. R. PINS AND BUSHINGS • PRECISION PARTS**

made. A simple gear-box permits the quick selection of any of the forty-eight thread-cutting and carriage-operating feeds that are available in either direction.

By the simple adjustment of two levers, any screw thread with from 8 to 224 threads per inch can be cut. Changing the 24-tooth stud gear to the 48-tooth stud gear furnished with the lathe makes it possible to cut additional threads from 4 to 7 per inch. Similarly, longitudinal power feeds from 0.0015 to 0.1 inch per revolution of the spindle can be obtained. The power cross-feeds are 0.25 times the longitudinal feeds.

Features designed to assure the required accuracy for precision work include preloaded ball-bearing headstock; countershaft designed to eliminate vibration, even at high speeds; and a heavy, well ribbed bed with precision-ground vee and flat ways. The swing over the bed is 10 1/2 inches, the bed length 43 1/8 inches, and the distance between centers 24 inches. 61



Tap Grinder Brought out by the Edward Blake Co.

Blake Tap Grinder

A new tap grinder for sharpening the chamfer on taps ranging in size from No. 0 to 2 inches in diameter and up to 14 inches in length has been announced to the trade by the Edward Blake Co., 634 Commonwealth Ave., Newton Centre, Mass. This grinder, known as the No. 2, is similar in construction to the No. 1 grinder made by this company, except that the length of the bed has been increased to accommodate longer taps.

The segment under the wheel-head slide is made sufficiently wide to allow the head to be swiveled to suit the chamfer angle by swinging it either in the conventional manner or around to the back of the work. This is an advantage when sharpening shell type taps or taps with long pilots, where the work must clear the wheel-head and yet be rigidly supported.

The No. 2 machine is equipped with a longer feed-screw to permit the wheel-head to clear the bed when it is swung to the extreme rear position. This machine is provided with change-gears for sharpening two, three, four, five, six, eight or ten flutes of either right- or left-hand type. Taps can be held in Blake bushings for rapid operation, in collets, or in the centers, as the user prefers, all three methods being always available. 62

Wallace Portable Automatic Bending Machine

The Wallace Supplies Mfg. Co., 1302 Diversey Parkway, Chicago, 14, Ill., has brought out a portable, full-automatic, hydraulic bending machine of new design that is available in three sizes for iron pipe up to 6 inches, or the equivalent bar stock, structural shapes, etc.

This machine is especially adapted for use where the variety of work to be handled is large and the number of pieces of any given radius is limited, and where the investment in tooling must be kept at a minimum. All bends are made by the cold method, thus eliminating heating and filling of the pipe prior to bending, which results in a considerable saving in time and expense.

The single control lever permits making bends of 90 degrees. The operator can control the stroke of the ram to suit the degree of bend or radius required. Bends of any radius can be produced ranging from a straight line to the minimum radius for which standard tooling is provided. Crooked pipes can be successfully straightened by reversing the procedure employed for bending. 63

Portable Automatic Bending Machine Made by Wallace Supplies Mfg. Co.

"Tornado" Electric Writing Tool

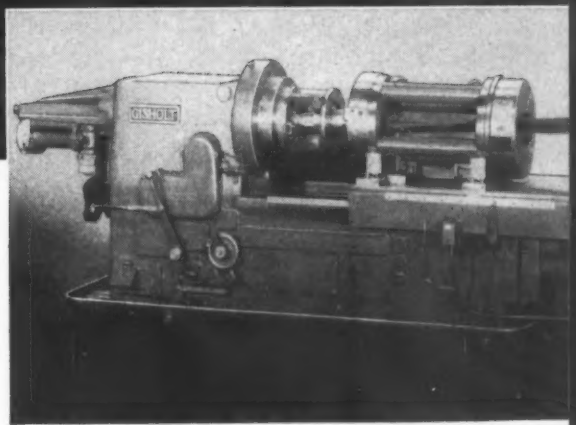
An electric writing tool has been brought out by the Breuer Electric Mfg. Co., 5100 N. Ravenswood Ave., Chicago, Ill., for use in permanently marking such materials as steel, bronze, brass, aluminum, hard rubber, plastics, marble, tile, or glass. The tool makes over 7000 cutting strokes per

To obtain additional information on equipment described on this page, see lower part of page 180.

Make it fit to fight!

WE REVVED UP PROP *Production,* TOO!

WITH GISHOLT SIMPLIMATICS



Hub ends of these steel propeller blades are machined both inside and outside by revolving tools on this special Simplimatic set-up, designed by Gisholt. With automatic feeds, speeds, and retraction of tools, very little operator training is required. Complete information on request.

Now, the principle of a stationary work piece machined by revolving tools has been applied by Gisholt to the automatic lathe. The special Simplimatic arrangement shown below is now used to speed up the production of propellers for Uncle Sam's war birds.

The engineering skill to solve all kinds of machining problems in a way that saves time and cost is the reason why leading concerns bring such special problems to Gisholt.

The Army-Navy "E" and the Treasury Flag fly side by side at Gisholt.

GISHOLT MACHINE COMPANY
1209 Washington Avenue, Madison, Wisconsin

Look Ahead...Keep Ahead...with Gisholt Improvements in Metal Turning

GISHOLT

TURRET LATHES • AUTOMATIC LATHES • BALANCING MACHINES

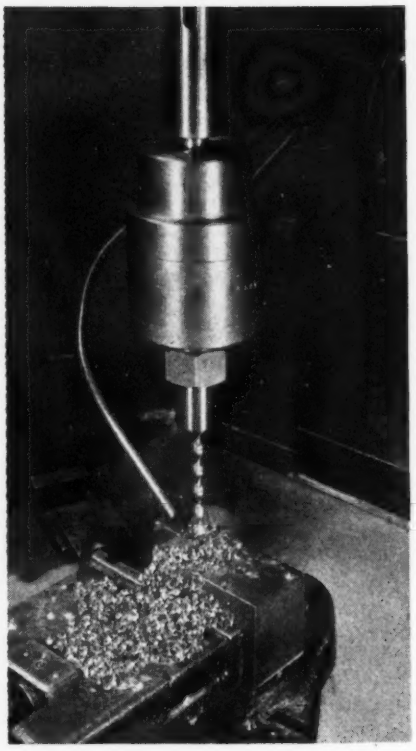
minute, adjustable for deep or shallow cutting, and leaving a permanent marking. It operates like a pencil, and writes as fast as the hand can move it. In use, it is simply plugged into a light socket. 64

Rego Karweit Driller

A device, known as the Rego Karweit driller, which eliminates many of the difficulties experienced in drilling, especially when holes deeper than five times the diameter of the drill are to be produced, has been brought out by the Bastian-Blessing Co., 4203 Peterson Ave., Chicago, 30, Ill. The device is mounted in a drilling machine in place of the conventional chuck. In operation, it lifts the drill a small amount during each revolution, thereby repeatedly breaking the chips to permit lubrication of both sides of the cutting edges.

The reciprocating action produces chips that are substantially uniform in size and shape for a given size of drill, and prevents the chips from packing tightly in the flutes.

It is stated that production has been stepped up from 30 to 50 per cent, and that the tool life in many instances has been more than doubled. This device has made it possible, when drills with long enough flutes are used, to drill holes as deep as twenty diameters in a continuous operation. Furthermore, drill breakage is reduced, and materials that are so hard and tough that they ordinarily give trouble are handled more easily with the new device. 65



Device Made by Bastian-Blessing Co. to Facilitate Drilling of Deep Holes

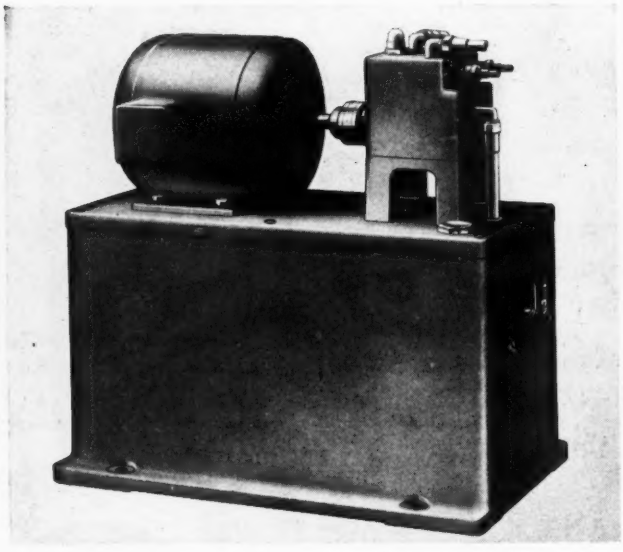
Anker-Holth Supercharged Hydraulic Power Unit

A supercharged combination high- and low-pressure oil hydraulic power unit, known as "Hi-Po," has been placed on the market by the Anker-Holth Mfg. Co., 332 S. Michigan Ave., Chicago, Ill., to meet the requirements for hydraulic units developing pressure in the 3000-pound range. This pressure is delivered by the use of a 1/2-H.P. motor employing a supercharger to preload the piston chamber, thereby reducing pulsation to a minimum. The pump and motor are mounted directly on the oil reservoir. A low-pressure bypass control having a range up to 300 pounds is built into the pump body. Both the high and low pressure can be controlled individually or automatically. 66

Feed Table for Abrasive-Belt Surface Grinders

The Porter-Cable Machine Co., 1801-8 N. Salina St., Syracuse, N. Y., has developed an "In-Out Feed" table designed to obtain speedier and more accurate surface grinding of disks, squares, and other small parts on the Porter-Cable G-4 belt type grinder. This accessory actually consists of two tables, one at each side of the abrasive belt. Both tables are adjustable to the level of the belt, and enable the stock to be fed to and received from the belt on a flat plane, thus avoiding the danger of nicking or non-parallel grinding of the work.

An adjustable rail, as shown in the illustration, holds the stock against the belt. The rail can be set at the correct angle to control the



Anker-Holth High- and Low-pressure Hydraulic Power Unit

Feed Table Applied to Porter-Cable Belt Type Grinder

To obtain additional information on equipment described on this page, see lower part of page 180.

amount of grinding. The table can be equipped with hopper and in-feed and out-feed chutes for semi-automatic operation. 67

Portable Boring and Facing Machine

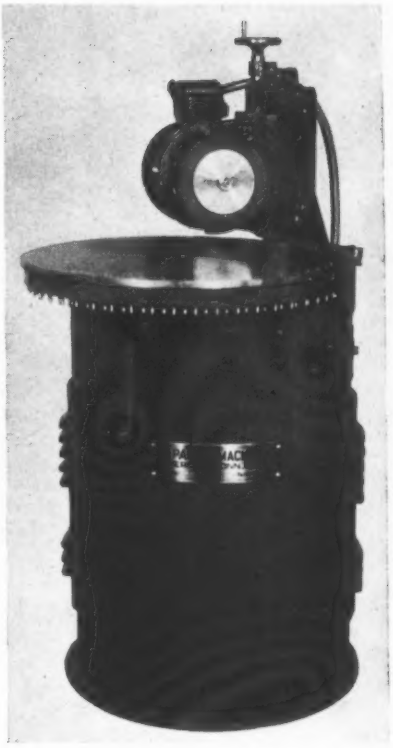
The General Engineering & Mfg. Co., 1523 S. Tenth St., St. Louis, 4, Mo., has brought out a portable machine for boring, turning, and facing operations on work such as lathe beds, press frames, bedplates, pipe headers, valves, etc., that is too large to be conveniently handled on standard machine tools. This machine can be taken to the work for machining pads and similar surfaces that could otherwise be finished only with considerable difficulty and expense.

The machine is mounted on a heavy base on which it can be traversed over a distance of 36 inches by means of a spindle. The automatic or crank-operated horizontal travel of the spindle housing has a range of 19 inches, and the crank-operated vertical travel is 24 inches. There are several spindle speeds ranging from 7 to 100 R.P.M., and four horizontal spindle housing feeds ranging from 0.009 to 0.063 inch. The faceplate has a diameter of 33 inches. All bearing surfaces and gears are lubricated by a pump-operated gravity oiling system. 68

Packer-Matic Continuous Rotary Grinding and Buffing Machine

The Packer Machine Co., Meriden, Conn., has brought out a No. 7 continuous rotary grinding, burring, polishing, and buffing machine developed primarily for use in removing burrs from studs, screws, and other parts of various shapes. A second head or wheel can be attached for performing multiple operations.

The table on which the fixtures or holding devices are mounted runs on a ball-bearing spindle, designed to facilitate changes that may be necessary in handling different kinds of work. Attachments are provided for the automatic discharge of finished work. Hopper feeds can also be used for many types of work. Grinding or buffiing wheels can be mounted in either vertical or horizontal positions as required. The table is 25 1/2 inches in diameter, and is positioned at a height of 36 inches from the floor. 69



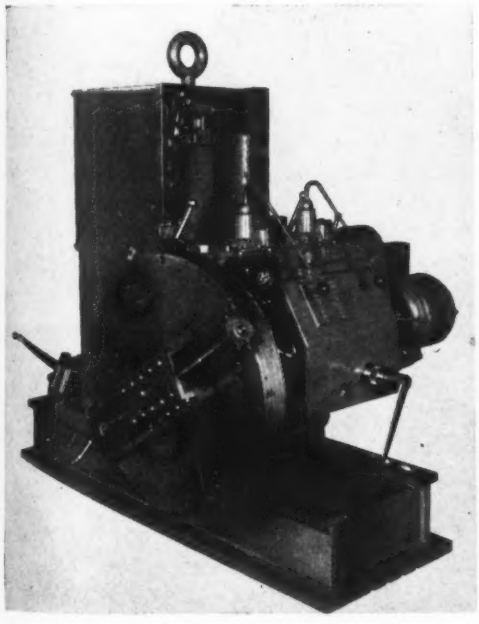
Continuous Rotary Grinding and Buffing Machine Brought out by the Packer Machine Co.

Oscillating-Spindle Sander

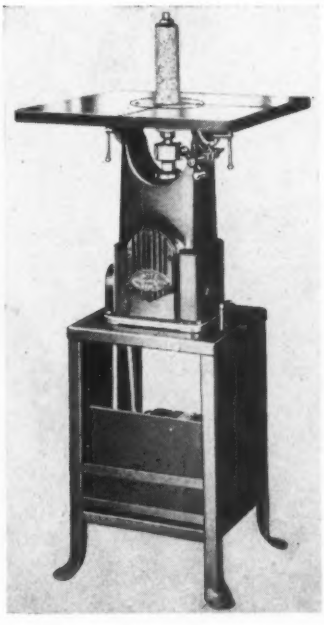
An oscillating-spindle sander designed for rapid production is a recent product of the Boice - Crane Co., 959 Central Ave., Toledo, Ohio. This sander employs small-diameter abrasive sleeves, the full range of sizes being 3/4, 1 1/2, 2, and 3 inches. It is portable and vibrationless, and will sand any degree of bevel on work up to 6 inches high. It can be used for grinding aluminum, brass, Masonite, die-castings, and sheet iron for templets.

Faces that blend gradually through different slopes at successive cross-sections can be easily handled. The sand drum oscillates automatically through a stroke of 7/8 inch, making eighty-three complete strokes at 2500 R.P.M.

The 20- by 20-inch table tilts to an angle of 45 degrees in both directions. Two scribed index lines show the exact positions for beveling, drafting patterns, and corebox work. The 3/4- and 2-inch nesting rings are regular equipment. The crankcase is dust- and leak-proof, and the bearings are packed in grease and sealed. 70



Boring and Facing Machine Brought out by the General Engineering & Mfg. Co.



Oscillating-spindle Sander Made by Boice-Crane Co.

Surface Plates Made from Natural Granite

An unusual type of surface plate is being manufactured by the Herman Stone Co., 1240 Leonhard St., Dayton, Ohio, for use in tool-rooms and production and inspection de-

To obtain additional information on equipment described on this page, see lower part of page 180.

Stepping Up . . . and Keeping Up the STEEL CUTTING PR

In England! American carbides—rushed to England when war cut off German supplies—have helped English industry drastically reduce war production time. Regular shipments of carbides—from Carboloy Company—started early in 1939.

Acme

In Russia! Underground shops, such as this, typify the grim determination of Russia in turning out war production to rout German hordes. American carbides—supplied since shortly after Russia joined the Allies—have helped Russian industry increase output.

IN SOUTH AMERICA!
IN AFRICA! IN AUSTRALIA!
IN MEXICO! IN INDIA
IN CHINA!
AND THROUGHOUT THE UNITED STATES

Up the NG PRODUCTION of the United Nations

WITH the outbreak of war in 1939 the Allied Nations—abruptly cut off from Germany as a principal source of supply for carbides—diverted the full flood of their carbide demands to the United States.

Fortunately, American industry had established—as far back as 1928—its own independent sources of supply. These American suppliers were ready to meet the emergency with a background of 10 years' experience in the development, manufacture and application of this urgently needed material. They had the skill, the equipment, and a generous margin of reserve capacity.

To the hard pressed Allied Nations—struggling to offset the tremendous output of a German war production long since tooled with carbide *by official decree*—went tons of American carbides in steadily increasing quantities. Foresight and preparedness enabled American carbide manufacturers to fill this urgent need and at the same time meet the pyramiding demands of domestic industries.

Today, you will find carbides a factor of vital importance in stepping up and keeping up the production of not only the United States but also such countries as England, Russia, Australia, Canada, China, India, Mexico and many others among the United Nations.

The full extent to which carbides are being used in the cause of victory is difficult to visualize. Carboloy Company production alone, for example, is at an annual rate 45 times greater than that of any pre-war year. Monthly production of carbides—formerly measured in pounds—can today be expressed in tons—many tons per month! Yet the average carbide tool contains but a fraction of an ounce of carbide at the cutting edge—and a single tool during its usable life machines hundreds of parts for the implements of war. Particularly important is the use of carbides for cutting steel—a major field of use for Carboloy tools. (More than 60% of the Carboloy Cemented Carbide produced today for machining purposes is for cutting steel.)

A high order of performance—so high as to have been once considered incredible—is now commonly expected, and obtained, with carbides. Such things as increases in output of 3 to 1, lengthened tool life of 10 to 1, finish cuts that eliminate arduous grinding, machining of former "non-machineable" alloys, reductions of 25%, 50%, 75% in machining costs—results such as these are every-day occurrences in war production today.

This widespread use of carbides in war, indicates a new era of production economy when normal commerce returns. Manufacturers who have converted to carbides to meet the present emergency will then have at their immediate disposal an economic weapon of unusual advantage in seeking world markets.

CARBOLOY
TRADEMARK

TITANIUM—
TANTALUM—
TUNGSTEN
CARBIDES

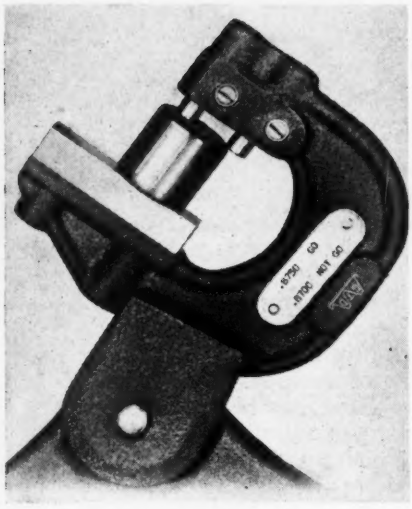
CARBOLOY COMPANY, INC.—DETROIT, MICH.

Birmingham, Ala. • Chicago • Cleveland • Los Angeles • Newark • Philadelphia • Pittsburgh • Seattle • Thomaston, Conn.
Authorized Distributors: Canadian General Electric Co., Ltd., Toronto. *Foreign Sales:* International General Electric Co., Schenectady, N. Y.

In Canada! In swiftly stepping up production Canada has extensively used carbides. Closely cooperating—Carboloy Company has not only supplied carbides but also helped furnish equipment and technique for rapid step-up in Canadian carbide production.

★

THIS WIDESPREAD USE OF CARBIDES IN WAR, INDICATES A NEW ERA OF PRODUCTION ECONOMY WHEN NORMAL COMMERCE RETURNS.



Snap Gage for Rapid Inspection Made by the Greenfield Tap & Die Corporation

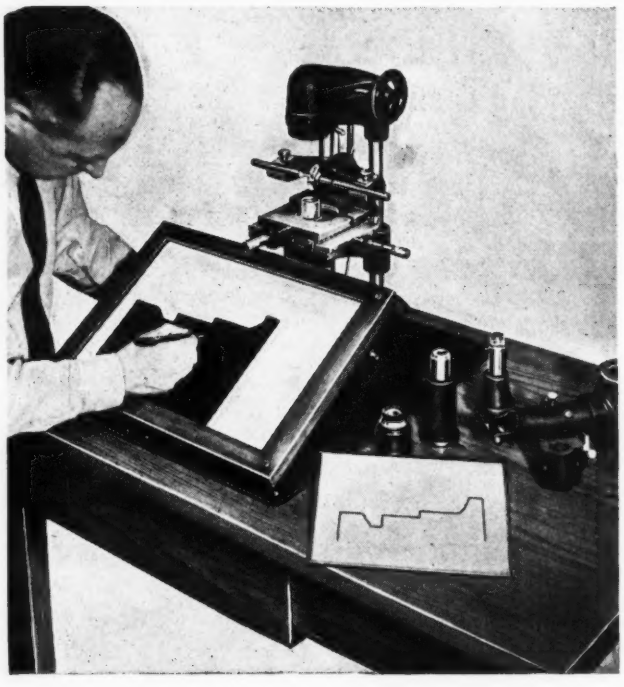
Limit Snap Gage for Inspecting Precision Parts

For more rapid inspection of precision parts with less wear on the gage, the Greenfield Tap & Die Corporation, Greenfield, Mass., has brought out a new No. 1618 limit snap gage. Its main feature is the extended lower anvil, which facilitates inspection by making it possible to locate and level the work more quickly and easily before it is moved toward the "Go" and "No Go" anvils. This advantage applies both to measuring diameters of round parts and to gaging external lengths. The extended anvil also facilitates gaging work in the machine. 73

partments. These plates are made from certain types of natural granite, and obviously will not rust, corrode, or warp, nor become charged with abrasive materials. It is stated that they are finished to a bearing surface within an accuracy of 0.0001 inch. 71

Wilder Projector

A new model Wilder projector, used for checking and inspection purposes, has been placed on the market by George Scherr Co., Inc., 128 Lafayette St., New York 13, N. Y. The new model has a 2-inch diameter condenser, which provides a larger beam of parallel light than formerly and permits the use of larger-diameter lenses in the lower-power series. In addition, the head is fully enclosed, with a better ventilated lamp house. Spiral gears are used in the focusing motion, the setting thereby becoming to a certain extent self-locking. The lenses are set in larger and heavier mounts, which facilitates changing and proper positioning in the lens cone. The projectors are available in six magnifications which vary from 10 to 100. 72



Wilder Projector for Checking and Inspection

Strickland Universal Ball-Joint Vise

The Strickland universal ball-joint vise, adapted for holding tools while grinding chip-breaker grooves and cutting edges to predetermined angles, is being placed on the market by the Wall-Colmonoy Corporation, 720 Fisher Bldg., Detroit, Mich. This vise is designed to save time and to provide means for making accurate precision settings to any simple or compound angle. The compound settings are made by simply matching the vertical degree graduations of the ball joint with the horizontal degree graduation required. A single movement of a clamping wrench serves to lock the vise.

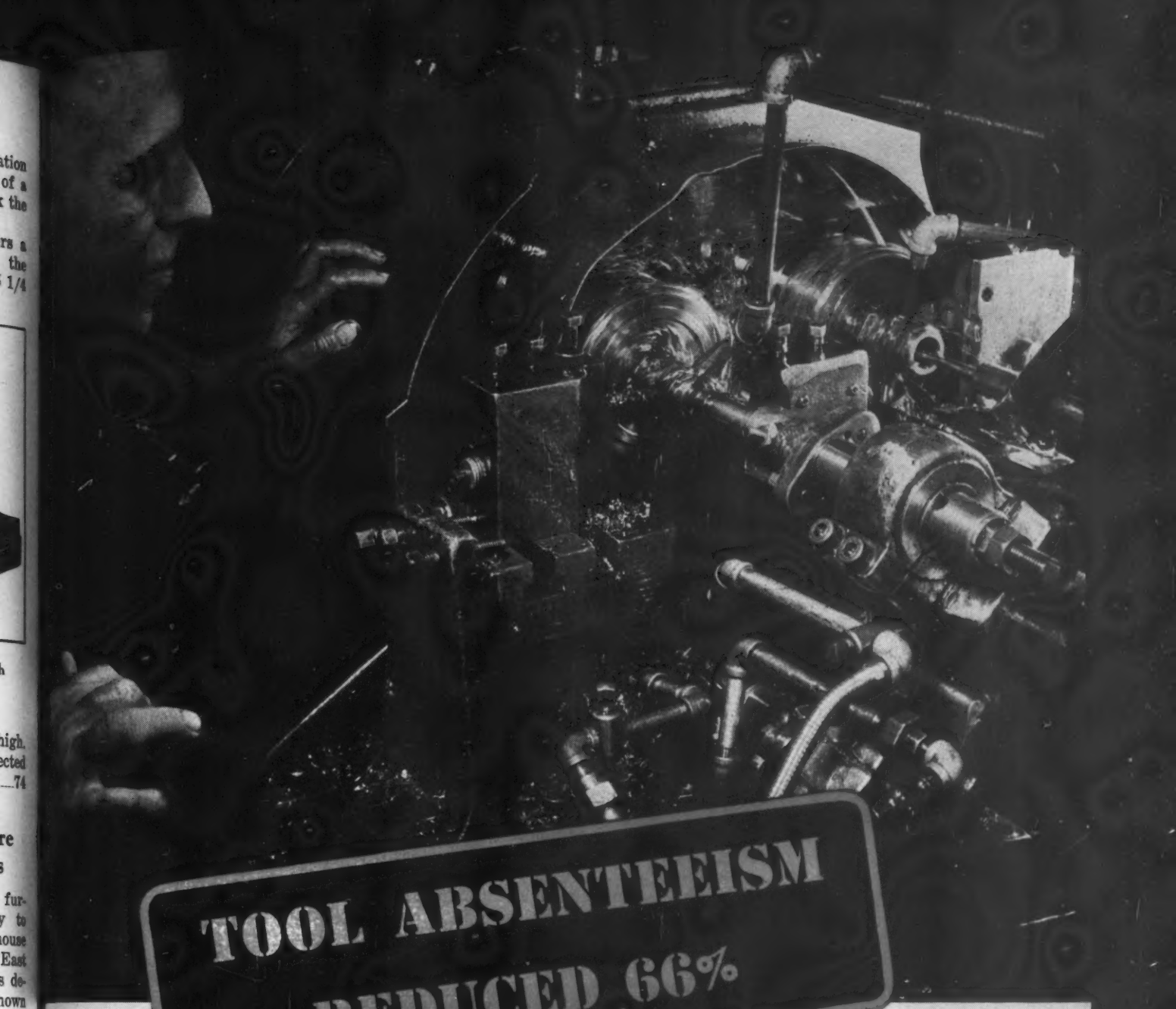
The adjustment range covers a 30-degree movement through the horizontal plane. The vise is 5 1/4 inches wide and 4 3/4 inches high. The ball and socket are protected by a leather dust apron. 74

Strickland Ball-joint Vise with Universal Adjustment

Electronic Temperature Control for Furnaces

Because electric resistance furnace temperatures are likely to vary, the Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa., has developed what is known as the Furnatron control system to keep such variations to a minimum. The new control system can be used for furnace temperature regulation and control either in single- or three-phase furnaces. Where the line or furnace transformer voltage is not suitable to supply alternating current to the thyratron tubes, an anode transformer is furnished. The complete regulator is arranged for flush-panel mounting, and the installation is guarded by protective devices which include a time delay relay, over-temperature mechanisms, surge suppressors, fuses, and disconnecting devices. 75

To obtain additional information on equipment described on this page, see lower part of page 180.



SUNICUT

...iples tool life . . . improves finish . . . increases production"

...ol "absentees" can hurt war production just as much ...the operator who stays away from his job. One large ...nt faced with the problem solved it this way.

...ery 4 hours time was lost in changing tools . . . regrind... caused production to lag. They called in a Sun ...ting Oil Engineer who studied the problem and rec...mended a change in cutting oil — to Sunicut 110.

...re are the results. Instead of time out for changing ...ls every 4 hours they now change them only every ... hours — a 200% increase in tool life! Sunicut's trans...rency permits easy inspection of work while machining . . . and a smoother finish is obtained. Because of less "time out" for tool changes production increased 20% . . . and is being stepped up still more since machine speeds have now been increased one-third.

Performance like this is winning Sunicut an outstanding reputation on all operations where a straight, sulphurized cutting oil is used. For longer tool life, better finish, increased production in your plant, call on a Sun Doctor of Industry to analyze your needs and recommend the proper grade of Sunicut today. Write

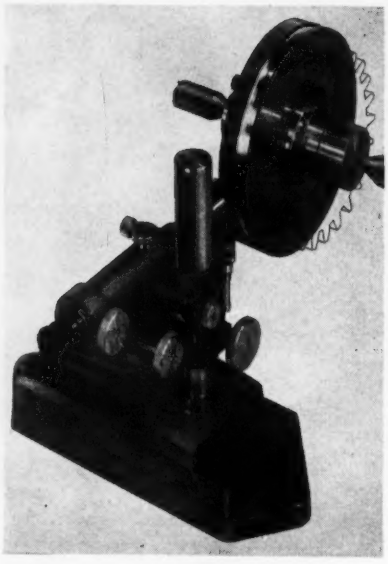
SUN OIL COMPANY · *Philadelphia*

Sun Oil Company, Ltd., Toronto and Montreal, Canada

...N INDUSTRIAL PRODUCTS

SUNOCO

HELPING INDUSTRY HELP AMERICA



Engis Circular Division Testing Instrument

Instrument for Checking Circular Spacing

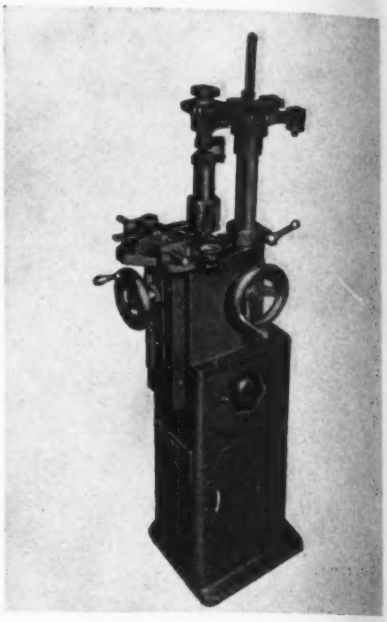
A precision circular division testing instrument suitable for checking spacings in gears, camshafts, splined shafts, or index-plates is a new product of the Engis Equipment Co., 310 S. Michigan Ave., Chicago, Ill. This instrument can be brought to the work, and is therefore suitable for checking large work as well as small. It consists essentially of a master circle unit and a microscope unit. In use, the master circle is attached to the part to be checked and is centered in its mounting by means of two fine radial adjusting screws in conjunction with a dial indicator held against a groove on the periphery of the master circle. This groove is adjacent to a silver band, accurately graduated to 1/6 degree (10 minutes).

The microscope unit consists of a base and upright for supporting the microscope. The setting and focusing of the microscope in relation to the master circle is accomplished by means of a rack and pinion motion. The reading of the micrometer is novel in that it is obtained entirely within the eye-piece. 76

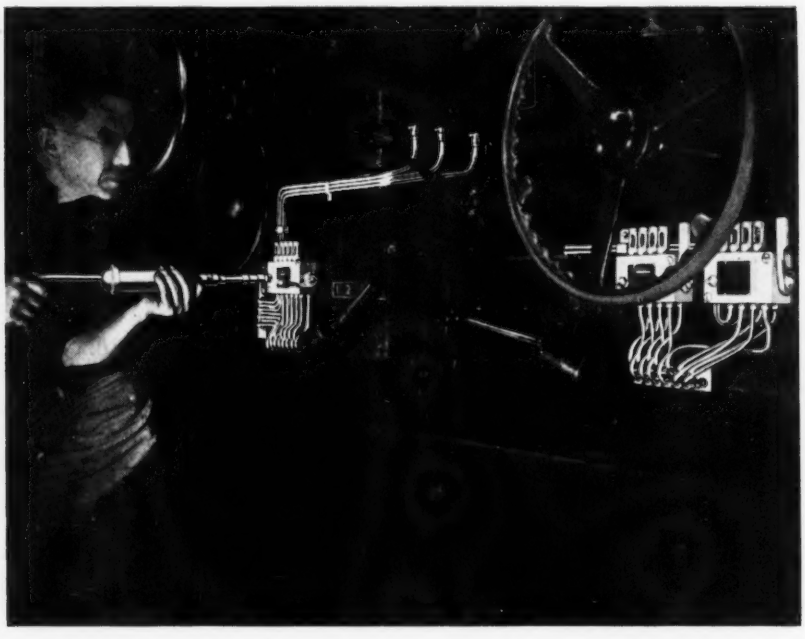
Farval "Multival" Lubrication System

The Farval Corporation, 3276 E. 80th St., Cleveland, Ohio, has brought out an improved "Multival" lubrication system designed to provide positive lubrication of all bearings on machine tools and similar equipment, regardless of their location or condition. Oil or grease under pressure is delivered to the distributing blocks by means of a manual or power-operated portable gun, which serves as a central pump.

Complete equipment consists of the multiple valve blocks, each serving two to ten bearings, lubricant lines leading to individual points, and suitable fittings to accommodate practically any type of bearing connection. This system can be readily installed by the regular shop maintenance crews. Each measuring valve can be individually adjusted to deliver the exact amount of lubricant required by the bearing it serves. A "tell-tale" on each valve piston indicates the positive delivery of lubricant to each bearing. 77



Checking Machine for Thread Milling Cutters, Made by Detroit Tap & Tool Co.



"Multival" Lubrication System of Improved Design Brought out by the Farval Corporation

Machine for Checking Thread Milling Cutters

A universal type machine designed to facilitate rapid checking of hook or rake angles and flute spacing when sharpening thread milling cutters has been developed by the Detroit Tap & Tool Co., 8432 Butler Ave., Detroit, 11, Mich. Visual aligning of a ground straightedge with the face of the cutter flute, as viewed against an illuminated background, permits the operator to read the offset distance directly from an integral micrometer barrel. By simply placing an indicator finger against the cutting face, any error in flute spacing can be read directly on an indicator dial which is part of the checking machine.

The measuring unit in which the ground straightedge finger and the indicator are mounted is provided

To obtain additional information on equipment described on this page, see lower part of page 180.

For Precision and Versatility

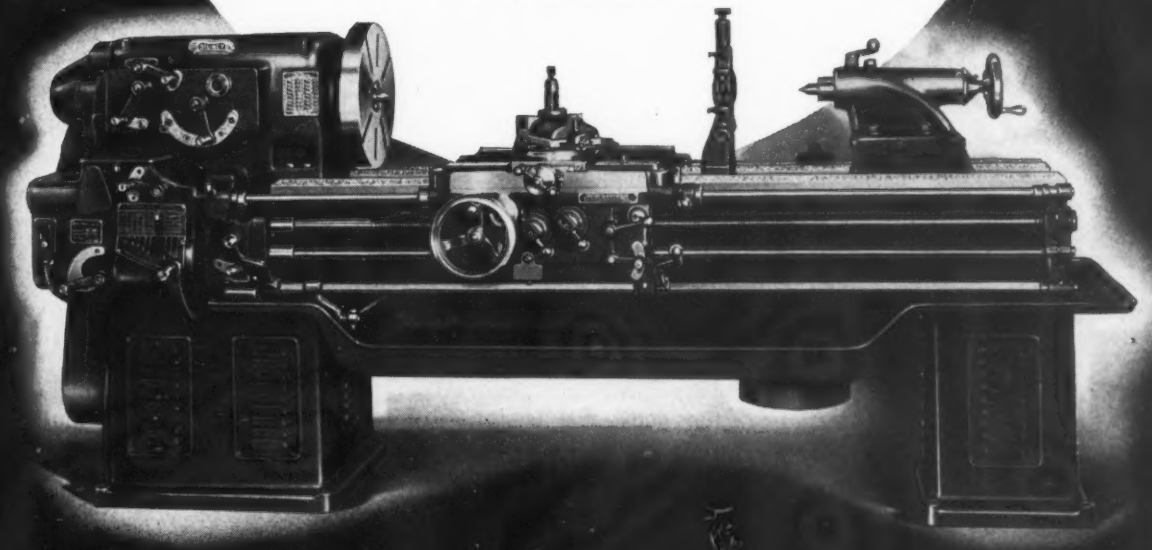
SIDNEY TOOL ROOM LATHES

● The wide range of work—the extreme tolerances demanded—the fine finish required in tool room operation finds hundreds of shops using Sidney Tool Room Lathes for this exacting work.

Sidney Tool Room Lathes are built in four sizes—from 14″ to 20″ inclusive. They have 16 speed continuous tooth Herringbone geared headstocks—48 feed changes from .0027″ to .172″—48 thread changes 1½ to 92—forced feed lubrication—anti-friction bearings throughout, all of which contributes to their wide range adaptability and long lived accuracy.

Built to rigid standards of Precision Accuracy.

Bulletins available.



The **SIDNEY MACHINE TOOL** *Company*

Builders of Precision Machinery

SIDNEY ESTABLISHED 1904 OHIO

with a vertical adjustment controlled by a handwheel. The two micrometer barrels that control the movement of the straightedge for right- and left-hand offsets are calibrated to measure the offset distance from a radial line. Directly beneath the straightedge is a diffused glass background illuminated by a lamp in the base. The spacing indicator and its finger are positioned to measure any error of cutting face spacing by comparison with the spacing of a master indexplate.

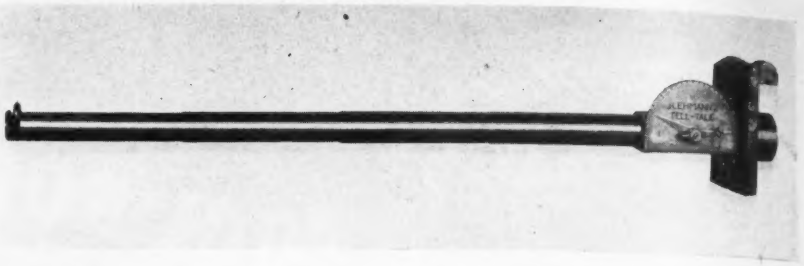
Both shell and shank type thread milling cutters from 1/2 inch up to 6 1/2 inches outside diameter and up to 12 inches in length, including arbor mount for shell types, can be checked on this machine. All cutting faces up to 7 inches of flute length can be inspected at all points for accuracy and uniformity of grinding. 78

Sheffield Thread-Roll Snap Gage

A combined "Go" and "No Go" limit gage of the thread roll type for the rapid checking of both maximum and minimum limits of external threads in one operation is a new addition to the line of gages made by the Sheffield Corporation, Dayton, Ohio. The gage consists of a frame similar to a plain snap gage, in which two sets of gage rolls are mounted, each being free to rotate. One set of rolls represents the "Go" limit and the other the "No Go" limit. These gages are especially adapted for use in aircraft, ordnance, and automobile work.

Advantages claimed for the thread-roll snap gages include faster inspection; economy due to long life because of comparatively little wear; and reduction in the number of gages required. One roll snap gage takes the place of two ring gages; in the case of a stud having both right- and left-hand threads, it replaces four ring gages. The rolls can be reground repeatedly. These gages are regularly furnished for the American National form, coarse and fine thread series. Gages for all other forms are made to order. 79

Sheffield Roll Type Snap Gage for Gaging External Threads



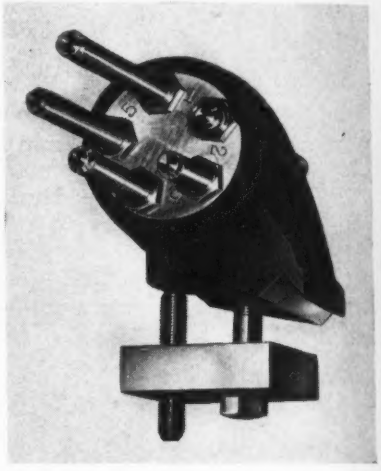
"Tell-Tale" Indicator Developed by Lehmann Machine Co., for Use in Deep-hole Boring Operations

"Tell-Tale" Run-Out Indicator for Deep Holes

The "Tell-Tale" indicator for measuring run-out in deep-hole boring operations, originally developed by the Lehmann Machine Co., Chouteau & Grand Blvd., St. Louis, 3, Mo., for use in machining 75-millimeter, 3-inch and 90-millimeter gun tubes on the company's special gun lathes, is now being made for a wider range of work.

The "Tell-Tale" indicator shown in the accompanying illustration is 58 inches long, and is designed to gage the run-out in holes approximately 2 1/2 inches in diameter or larger. Similar indicators have been made in lengths up to 110 inches for holes 3 inches in diameter or larger, and can be furnished for a greater range of sizes. The indicator shown is adapted for mounting on a hexagon turret face, but other mounts can be furnished to suit requirements.

In operation, the indicator is introduced in the hole to be gaged with the roller on the end in contact with the upper wall of the hole. The work is then revolved slowly, causing the run-out to be indicated in thousandths of an inch on the dial. The necessary adjustments can then be made, the progress of which is indicated on the dial. Two adjustably mounted indicator hands are provided, one of which can be set for a plus or minus rating, while the other is arranged to indicate the total run-out. 80



Five-position Multi-Stop for Lathes

Victor Five-Position "Multi-Stop" for Lathes

The ADT Victor multi-stop, shown in the accompanying illustration, is now being distributed by the Marshall Tool & Supply Co., 1224 Santa Fe Ave., Los Angeles, 21, Calif., in four models as follows: Universal No. 1A for 9- to 12-inch V-bed lathes; Universal No. 2 for 14-inch and most larger lathes; a special model for Atlas-Craftsman 9- and 12-inch lathes; and a special model for the Atlas-

To obtain additional information on equipment described on this page, see lower part of page 180.

ONE OF A SERIES OF SUGGESTIONS TO AID PRODUCTION

ONE OF A SERIES OF SUGGESTIONS TO AID PRODUCTION

THIS DIAGRAM SHOWS HOW "CHATTER" DEVELOPS

HOW TO SOLVE

Operating Problems with *Correct Lubrication*

1 SLIPPING

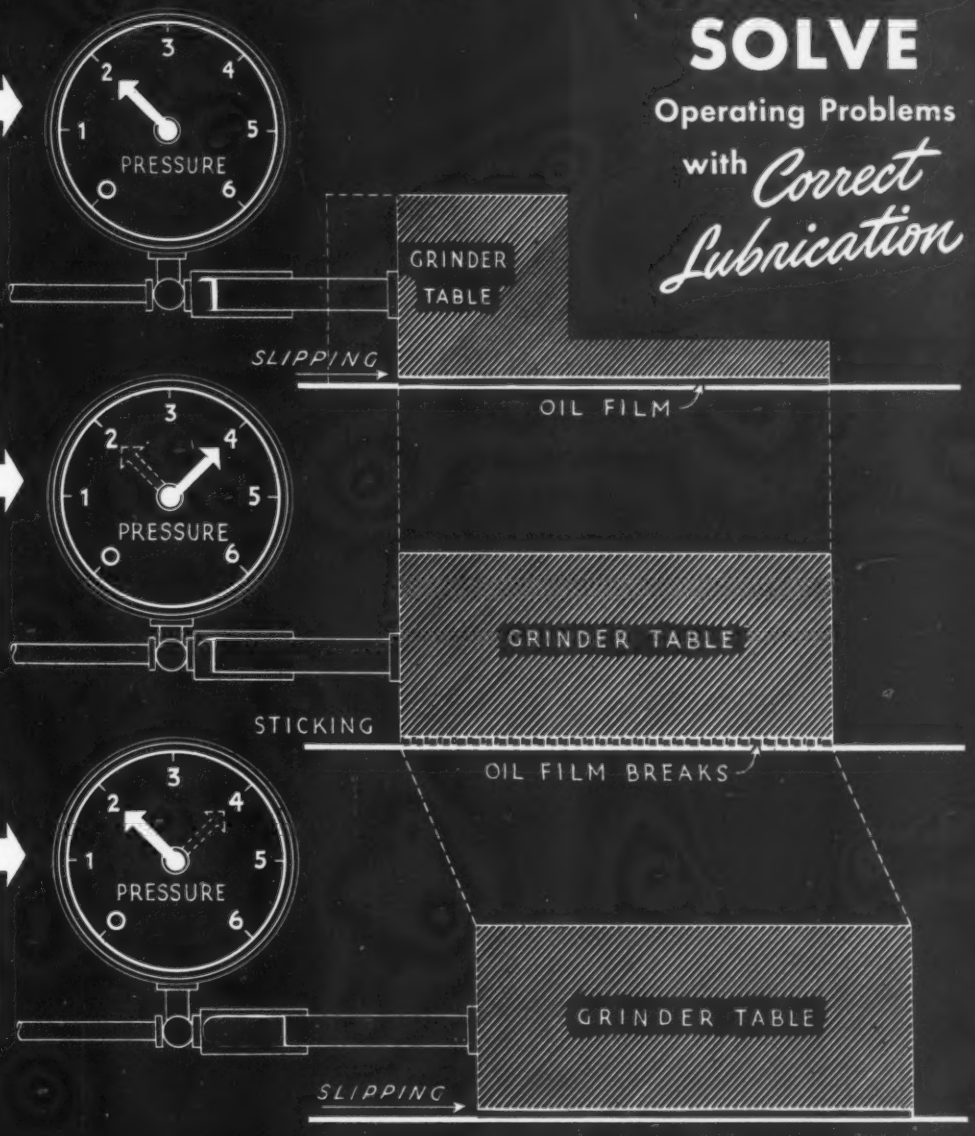
This diagrammatic drawing shows a grinder table moving ahead slowly under normal actuating pressure.

2 STICKING

The oil film breaks. Friction stops the table. The actuating pressure builds up to overcome the increased friction.

3 SLIPPING

The table jerks ahead. Pressure momentarily drops to normal. The table will immediately stick again.



Prevent "Stick-Slip" Chatter on Precision Grinders

THERE IS a special oil—Gargoyle Vacuoline Oil 1409—made to prevent "chatter" in grinding operations.

This oil has a thin, strong film that provides a minimum of "break-away" friction. It is made to eliminate Step No. 2 in the diagram above.

It is also made to eliminate "over-run" of the cross-slide which results from the same cause as "chatter."

In addition, it is an efficient hydraulic fluid—an ideal oil for hydraulically driven precision grinders.

Use Gargoyle Vacuoline Oil 1409 for assurance of securing fine finishes and meeting exacting tolerances.

GARGOYLE Lubricants

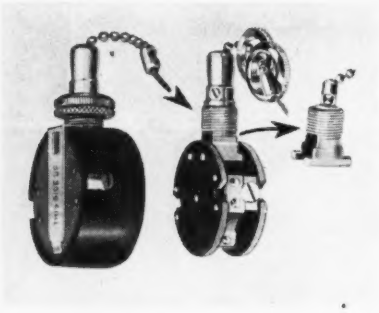
SOCONY-VACUUM OIL CO., INC.—Standard Oil of N. Y. Div. • White Star Div. • Lubrite Div. • Chicago Div. White Eagle Div. • Wadhams Div. • Magnolia Petroleum Co. • General Petroleum Corporation of Calif.

USE GARGOYLE VACUOLINE OIL 1409

Craftsman 6-inch lathe. When used in conjunction with a toolpost turret, this multi-stop, with its five positions for the carriage, makes possible the efficient handling of a wide range of work on the engine lathe. 81

Levolier Switch with Plastic Casing

To meet wartime needs and to release critical materials such as brass and steel, the McGill Mfg. Co., Inc., Valparaiso, Ind., has redesigned its No. 1010 Levolier switch to permit using a plastic casing in place of a brass shell. This



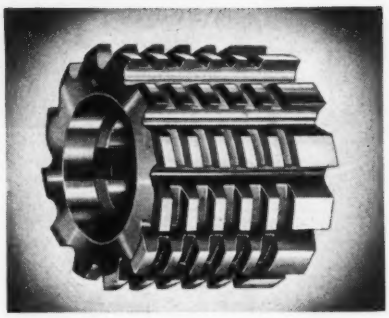
Switch with Plastic Casing Made by McGill Mfg. Co.

change is claimed to have released sufficient brass for the production of approximately four million 0.30-caliber shells per year. In addition, a saving in critical metal is also effected through the use of a plastic material in the fabrication of the frame to which the top and bottom disks are secured. 82

Plan-O-Mill Multiple Thread Milling Cutters

A complete line of multiple thread milling cutters in which the "Higbee cut" feature has been incorporated has been made available by the Plan-O-Mill Corporation, 1511 E. Eight Mile Road, Hazel Park, Mich. These new cutters, known as "Multi-Millers," make possible the milling of a complete precision thread in a single operation.

The "Higbee cut" feature is designed to remove the imperfect thread or "feather edge" at the same time the thread is milled. As a result, a saving in man and machine hours is achieved and a better, more accurate, and longer lasting part is produced.



Plan-O-Mill Multiple Thread Milling Cutter

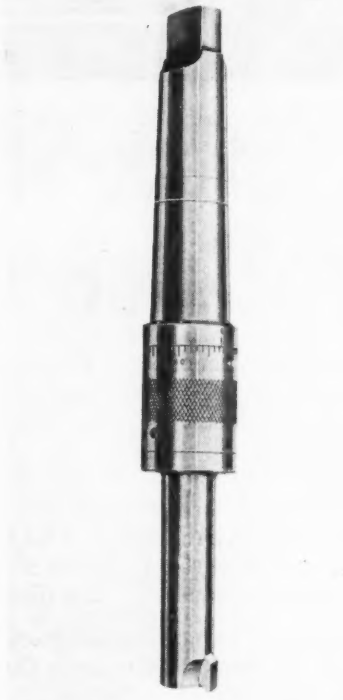
This line of cutters is available in National, Whitworth, Acme, vee, and special forms, with straight or spiral flutes. They can be had either ground or unground in a complete range of sizes for use on any type of thread milling machine. 83

"Mikro-Lok" Boring-Bars

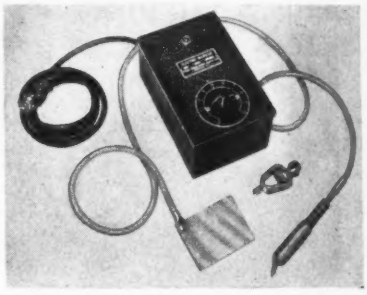
The Universal Engineering Co., Frankenmuth, Mich., announces the addition of "Mikro-Lok" boring-bars to its line of precision tools. These boring-bars are designed to take finishing cuts, and are especially adapted for boring to a square shoulder or to the bottom of a blind hole. They can also be used to advantage for work requiring intermittent cuts. The blade protrudes through the end of the bar, thus permitting the chips to fall ahead of the cutter.

Within the bar is a micrometer adjusting dial by means of which the blade can be set and locked for boring to the desired size within very close limits. The adjusting mechanism is entirely enclosed to prevent the accumulation of substances that might obstruct its free operation or affect its accuracy.

These boring-bars are made in sizes for boring holes from 3/4 inch to 5 1/4 inches in diameter, and are available with taper shanks for Swiss jig boring machines, Morse taper shanks, straight shanks, and a variety of flanges for diamond boring machines. Several sets of blades can be arranged with tandem or independent "Mikro-Lok" adjustment. 84



"Mikro-Lok" Boring-bar Made by the Universal Engineering Co.



Electrical Marker Made by the H. P. Preis Engraving Machine Co.

Preis Free-Hand Electrical Marker

The H. P. Preis Engraving Machine Co., 157 Summit St., Newark, N. J., has recently added to its line of marking equipment a device for placing numbers, symbols, and identifications on soft or hardened steel, alloy steels, other ferrous alloys, and wrought and cast iron. Designed primarily for free-hand marking, this equipment can be used also as an attachment to the Preis Panto electrical marker for pantographic reproduction work.

The equipment consists of a special transformer with ten voltage stages controlled by a rotary switch; a hand-held marking pencil; a ground plate for use with small work; and a ground clamp for large work. The voltage selection control makes it possible to obtain any desired depth of marking,

To obtain additional information on equipment described on this page, see lower part of page 180.

★ Back from a bombing mission—an engine missing—a rudder all but shot away. Under trees, on sandy deserts, our skilled Air Corps mechanics are "keeping 'em flying"—within earshot of enemy guns.

Get 'er *Flying* in a hurry

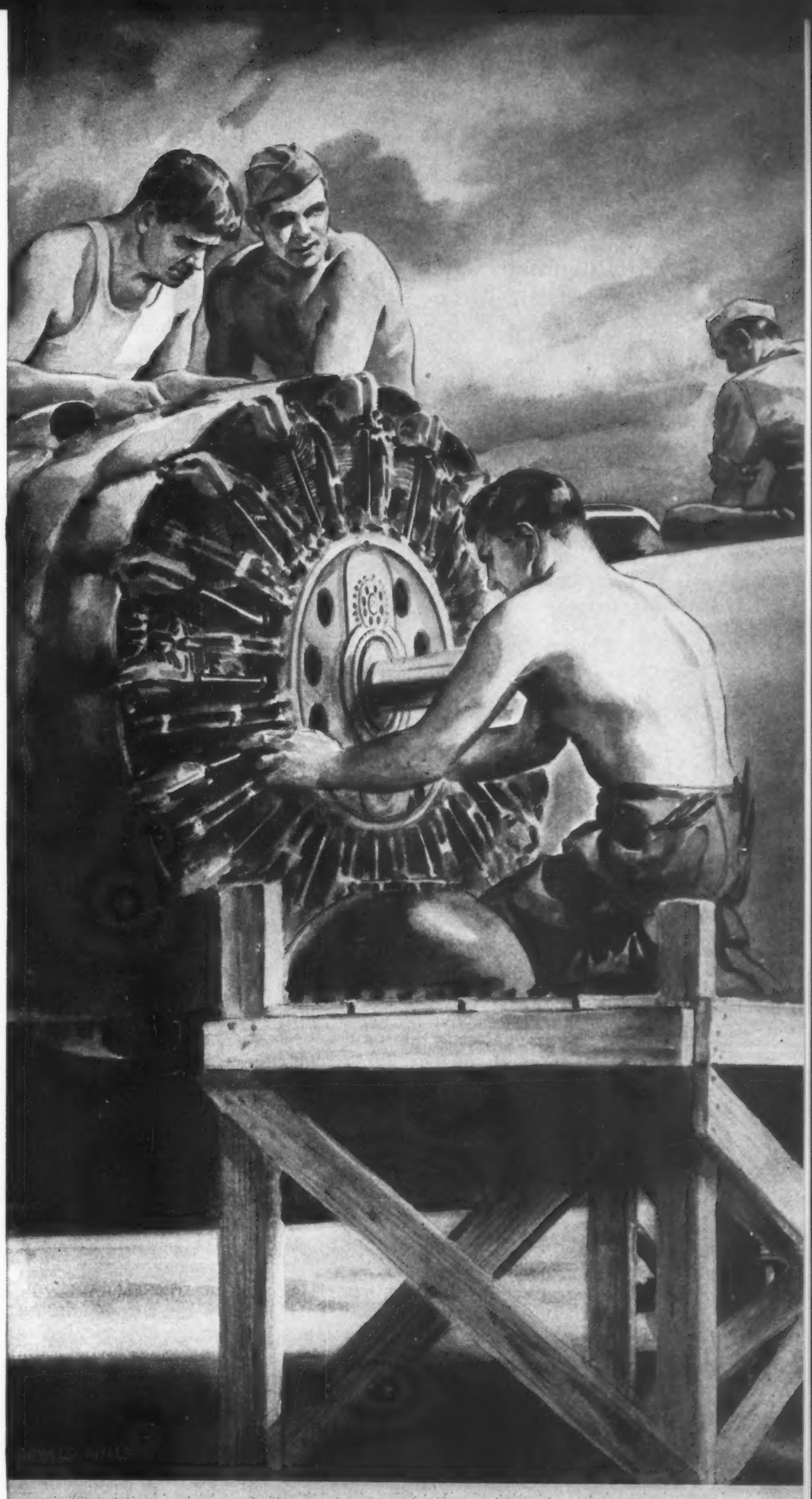
When a mission must be carried out, there is no time to baby an airplane! The machine shop may be under a tree with the sky for a hangar roof, but the orders are: "Get 'er flying—in a hurry!"

It takes a tough ship to stand the daily pounding these missions entail. It takes a tough engine to keep that ship flying with minimum time out for repairs and overhauls. And this is the job that Pratt & Whitneys are performing—a job that is writing their fame in smoke and fire over Axis-ruled lands.

But the toughness of these engines comes, not from rugged construction—not from "beefed up" parts, but from the close tolerances to which every part is held—a precision that makes possible great strength coupled with lightness.

The lightweight precision gears that have been developed for this engine—gears that are today being made in huge quantities at Foote Bros.—give promise to American manufacturers of new efficiency and new economy in the transmission of power when the war is won.

FOOTE BROS. GEAR AND MACHINE CORPORATION
5225 S. Western Boulevard • Chicago, Ill.



ARMY E NAVY

FOOTE BROS.

Better Power Transmission Through Better Gears

from the faintest line to the heaviest arc required for penetrating through scale or dirt on castings or heat-treated parts. 85

Aro Pneumatic Drill with Plastic Case

A small-sized, light-weight pneumatic drill with plastic housing and handle has been brought out by the Aro Equipment Corporation, Bryan, Ohio. This tool weighs only 1 pound 12 ounces; its lightness makes it particularly suitable for women workers. It is 6 1/4 inches in length. The new tool operates at 2500 R.P.M., and accommodates drills from 1/8 to 5/16 inch, held in a Jacobs chuck..... 86

* * *

New Timken Steel of Great Importance in War Effort

A new type of alloy steel, details pertaining to which cannot now be made public, has been developed through the efforts of Martin Fleischmann at the Timken Roller Bearing Co., Canton, Ohio. The use of this new steel enables aircraft to fly at altitudes above the effective range of anti-aircraft fire. It is a special, tough, heat-resistant steel that is used for a vital part of aircraft turbo-superchargers, thereby adding several thousand feet to present high-altitude flying limits.

* * *

Commercial High-Speed Motion-Picture Camera

A high-speed motion-picture camera for industrial use, capable of making over 3000 exposures per second, is being made available to industry by McLarty Business Films, 986 Ellicott St., Buffalo, 8, N. Y. By means of this high-speed motion-picture camera, it is possible to study such things as the behavior of materials during elongation, chip flow from tools during machining operations, effect of coolant on metals and tools, action of metal during welding, effect of vibration and impact, clearances between moving parts, causes of failures in rapidly moving machinery, etc.

Effect of Modern Machine Tools on the War Effort

Machine tool operators in this war average at least twice the output that they achieved in the last war, and the increased output is turned out with far less physical effort. This is due to the improved design and increased productivity of modern machine tools. Standard machines, with today's high-speed cutting tools, remove metal at a rate that would have seemed incredible twenty-five years ago in the first World War.

Machine tool design has tended constantly to take more and more of the physical effort away from the operator and to make the machine do the work, the operator chiefly providing the guiding intelligence. Today, in most cases, little actual physical strength is needed to run a machine tool. There are levers to be pulled, controls to be watched, buttons to be pressed, measurements to be taken with gages or micrometers. The operator uses brains rather than brawn. For this reason, with proper training, women can run machine tools as well as men, and women are beginning to take an important place in the production of machine tools themselves. Today, there are thousands of women helping to build machine tools, working side by side with men.

Developments in Packaging Machinery

The demands for proper packaging of munitions and other war materials have stimulated the development of new packaging machines. In a competition sponsored by *Modern Packaging*, a special award was made to the New Jersey Machine Corporation for the development of an automatic labeling machine that applies paper labels to cartridge boxes at the rate of 2250 boxes an hour, compared with the previous rate of 300 an hour. The same company has developed automatic machines for loading cartridges into boxes and for placing cartridges in the fabric belts used in machine guns.

A special award was presented to the Package Machinery Co. for the development of a clip-loading machine that fills 70 clips for the Garand rifle at a rate that means handling 560 cartridges a minute, approximately eight times the former speed for this operation. This machine has automatic controls to prevent inserting damaged cartridges in the clips and to safeguard against partially filled clips. Another machine developed and manufactured by the Package Machinery Co. loads cartridges into clips for the Springfield rifle at the rate of approximately 600 cartridges a minute.

Difference between Ordinary and Atomic-Hydrogen Arc Welding

Atomic-hydrogen arc welding is the result of research work in the early 1920's by Dr. Irving Langmuir, General Electric research chemist and Nobel prize winner. According to the General Electric Co., it differs from the ordinary arc-welding process in that the arc is maintained between two electrodes rather than between one electrode and the work. Because the location of the arc can be controlled and because the arc has no tendency to blow the molten metal out of the joint, extremely precise control of metal fusion is afforded. This is particularly valuable where high-strength joints must be produced.

The process employs a stream of hydrogen gas in which a change of molecular state enables the arc to heat the work to be welded at a high rate of speed. This change—the breaking down of ordinary hydrogen into the atomic state—gives the process its name. Hydrogen excludes oxygen and other gases that would combine with the molten metal to form oxides and other impurities. The deposit is uniform, dense, and free from pinholes, providing a clean weld surface which is easy to finish.

To obtain additional information on equipment described on this page, see lower part of page 190

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TOOL-TIPPING PROCEDURE—3
Welding—1

Resistance Flash Welding

This method is particularly adapted to butt-welding a high-speed steel tip to a low-carbon steel shank, but can also be used for welding a tip to the face of a low-carbon steel shank adjacent to the end, although considerable care is required in this procedure.

It is desirable, for butt welds, that the areas of the sections of the two parts to be welded be as nearly equal as possible, in order to avoid disproportionate rates of heating. A difference of 10 per cent is the maximum that should exist in applications of this method.

Apparatus—A tempering furnace. A standard resistance flash welder, manually operated or motor or hydraulically driven, and equipped with changeable copper dies machined to fit the contours of the sections to be gripped during welding.

A.—Procedure for Welding Hardened High-Speed Steel—

1. Preheat the parts to be welded to about 1000 degrees F.

2. Clamp the tip or stub in one pair of welding dies, and the shank in the other pair.

3. Make sure the alignment is correct.

4. Weld. The duration of the flash, the pressure, and the amount of upset required for an efficient resistance flash weld are details that can be learned only through experience. Assistance can be obtained from the manufacturer of the welder.

5. Immediately at the conclusion of the weld, place the tool in the furnace at a temperature of 1000 to 1050 degrees F. and maintain this temperature for about two hours. This will relieve thermal stresses at the welded section. The tool should not be permitted to cool in air from the welding heat.

6. At the end of the tempering period, remove the tool from the furnace and cool in air.

7. Remove the flash and dress the upset.

8. Form the cutting edge.

B.—Procedure for Welding Annealed High-Speed Steel Blanks to Low-Carbon Steel Shanks, Not for Subsequent Forging—

1–4. Same as under "A."

5. At the conclusion of the weld, bury the tool in lime, mica, ashes, or other inert material until cool to prevent excessive thermal shock.

6. Anneal the tool according to high-speed steel practice.

7. Remove the flash and dress the upset.

8. Form the cutting edges.

9. Harden and temper according to high-speed steel practice.

C.—Procedure for Welding Annealed High-Speed Steel Blanks to Low-Carbon Steel Shanks for Subsequent Forging—

1–4. Same as under "A."

5. From the welding temperature, cool the tool in lime, ashes, or other inert material.

6. Anneal the tool according to high-speed steel practice.

7. Forge. Then cool in lime, ashes, etc.

8. Anneal according to high-speed steel practice.

9. Form the cutting edges.

10. Harden and temper according to high-speed steel practice.

Compiled by Tools Division, War Production Board

TOOL-TIPPING PROCEDURE—4
Welding—2

Pressure Welding

This method is suitable for joining high-speed steel stubs to low-carbon steel shanks. The minimum size that can be welded economically is about 1/2 inch.

Apparatus—Manual, mechanical, or hydraulic pressure machine that can apply 4000 to 4500 pounds per square inch of pressure. Pressure gage capable of measuring twice this pressure. Alignment holding jigs. Heating apparatus, variable with size and shape of cross-section to be welded, providing for oscillation of flame through a short distance above and below weld section. Auxiliary furnace capable of attaining temperature of about 1650 degrees F. for slow-cooling welded piece.

Procedure—

1. Smooth cut sections to be welded. A smooth machine finish or equivalent is satisfactory. The cut must be perpendicular to the length of the pieces.

2. Secure the high-speed steel stub and low-carbon steel shank end to end in the welding apparatus.

3. Apply an initial end pressure of about 1000 pounds per square inch of joint cross-section.

4. Ignite the gas in the heating head. Adjust the flame to a neutral or slightly reducing ratio.

5. Oscillate the heating head across the weld interface through a distance of about one-third the weld face diameter in each direction from the weld face, allowing a slightly longer play of flame on the high-speed steel side. The pressure will now rise rapidly, due to thermal expansion of the heated sections. Then as the metal in this weld zone becomes heated into the plastic range the pressure gradually falls off. This will be at a temperature of 2300 to 2500 degrees F.

6. When the welding pressure has dropped to a predetermined value of between 3000 and 4000 pounds per square inch, maintain this pressure, either manually or automatically. Upsetting will now take place.

7. When a predetermined optimum weld upset has been reached, release the pressure and remove the piece.

8. Immediately transfer the piece to the annealing furnace at about 1650 degrees F.

9. Cool the piece to room temperature at the rate of 100 degrees F. an hour or slower. If this cooling cycle is followed, a hardness of 325 B.H.N. or less will result.

10. Remove the excess weld metal.

11. Machine the cutting edges.

12. Treat the tool according to standard practice for the grade of high-speed steel used.

Compiled by Tools Division, War Production Board

MACHINERY'S HANDBOOK

The "Bible" of the Mechanical Industry

MACHINERY'S Handbook contains 1815 pages of mechanical tables, rules, formulas and general data needed wherever machines, tools or other mechanical appliances are designed and constructed. It is reliable, complete, and simple in arrangement and is full of standard data and thoroughly practical information.

Shop men, as well as engineers and designers, find MACHINERY'S Handbook invaluable. It contains the kind of information that is required every day in manufacturing and designing departments.

Price $6—
payable $2 with order,
$2 monthly if desired.

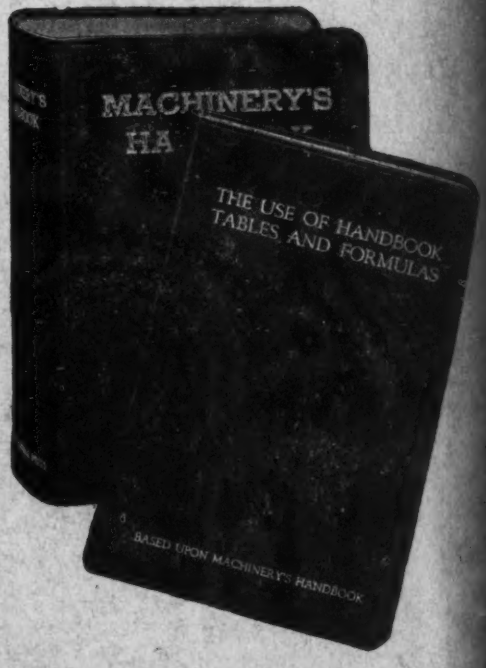
THE INDUSTRIAL PRESS, 148 Lafayette Street, New York 13, N. Y.

THE USE OF HANDBOOK TABLES AND FORMULAS

A companion book which shows you how to get the most out of MACHINERY'S HANDBOOK

This companion book, which costs only $1, serves three purposes: It throws the spotlight on a lot of essential time-saving tables, rules and general information in MACHINERY'S Handbook that the ordinary user never discovers.

A second and equally important function is to show by examples, solutions and test questions, typical applications of handbook matter in both drafting rooms and machine shops. A third object is to provide test questions and drill work designed for use in technical schools and machine-shop training courses so that students will learn at the outset how to apply an engineering handbook.



203 Pages, 63 Illustrations, 500 Problems, Exercises, Test Questions, Price $1; with MACHINERY'S HANDBOOK, $7.

THE INDUSTRIAL PRESS, 148 Lafayette Street, New York 13, N. Y.

Plan for Employing Incapacitated Ex-Servicemen

The Gray Mfg. Co., Hartford, Conn., announced a plan several months ago for employing incapacitated ex-servicemen. The company feels that we owe every possible opportunity to the men who have fought for us. A large number of the men who are now beginning to return to this country because of injuries will be able to resume industrial employment. As many of them as possible should be given the opportunity to rehabilitate themselves as members of the industrial community.

The company placed an advertisement in various newspapers under the heading "A Sincere Message to Disabled and Incapacitated Ex-Servicemen." Letters were also addressed to prominent leaders throughout industry. The response was immediate and cordial. One national association in the metalworking field requested 1200 copies of the advertisement to send as a model appeal to its various branches. The Gray Mfg. Co. states that, judging from the replies received, the idea has taken hold and is becoming the spearhead of a national drive.

The application of the program in the plant, however, has been slow. Requests have come from a number of veterans of the first World War, but up to early August, none from servicemen in the present war. Apparently few, if any, of the injured are as yet discharged and capable of taking jobs. It is expected, however, that during the next few months an increasing number of applicants will be heard from.

In carrying out the program, the company has been offered the services of veterans' associations and also of the United States Employment Service. It is understood that the United States Government is planning programs of training for those who wish to enter vocations other than those in which they were engaged previous to being inducted into the Armed Services. Through cooperation with these various agencies, industry should be in a position to offer effective employment programs to incapacitated ex-servicemen.

Collection of Broken Ends of Drills, Taps and Studs Removed by Welding a Nut to the Broken Piece and Applying a Wrench

Removing Broken Studs and Taps by Welding Nut to Broken Piece

The broken ends of drills, taps, and studs shown in the accompanying illustration were removed from castings and fabricated parts in various stages of completion by the ingenious expedient of welding a nut of suitable size to the broken piece and applying a wrench to the nut.

The parts removed in this manner were all broken well below the surface of the work, which made removal more difficult. They are typical examples taken in one department of the Switch-gear Division of the Westinghouse Electric & Mfg. Co., where the method was developed.

In applying the method, a coated welding rod is used to build up the broken stud, tap or drill to the surface of the part in which it has been broken off. The flux from the rod coating prevents the metal from "freezing" to the sides of the hole. A nut of suitable size is next placed over the hole and welded to the broken member, which can then be removed by applying a wrench to the nut.

Report on the Patent System

In December, 1941, President Roosevelt created the National Patent Planning Commission "to conduct a comprehensive survey and study of the American patent system." Of this commission, Charles F. Kettering, of the General Motors Corporation, is chairman; other members include Owen D. Young, of the General Electric Co., and A. A. Potter, dean of engineering, Purdue University. The first report of the commission was transmitted to the President in June, this year. It is concerned with questions of broad policy in connection with the patent system itself and the use of patents.

Briefly, the report emphasizes these points: (1) The principle of recognizing a property right in intellectual creation is sound and should be continued. (2) No serious problem is involved in patents in the war effort.

Certain modifications are proposed in existing patent laws. Among these are: Recording of all patent agreements; cancellation of patents that later developments may show should not have been issued; referring court records in infringement suits to the Patent Office for an opinion; establishment of a single Court of Patent Appeals; and limiting the patent term to not more than twenty years after the application is filed.

Brown & Sharpe Handles Absenteeism by Unique Methods

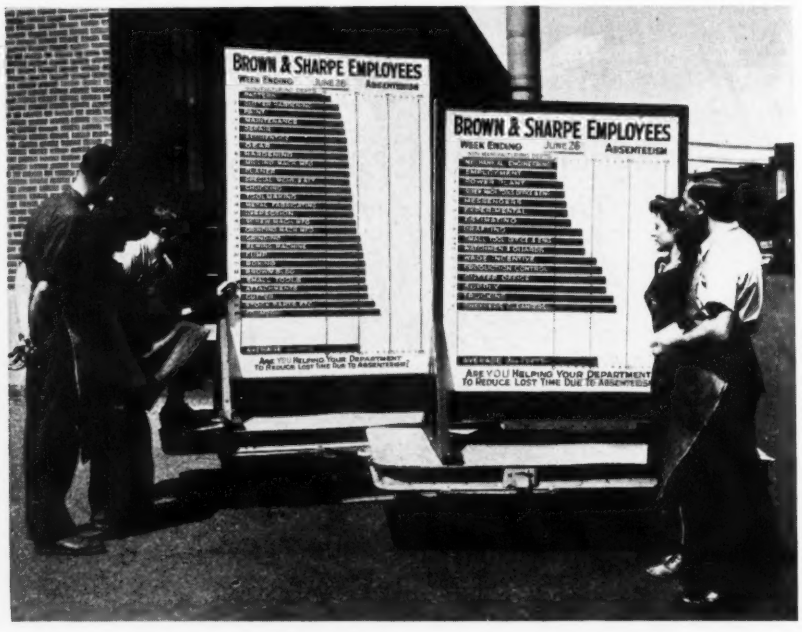
For the six months prior to March 1, this year, the absenteeism at the Brown & Sharpe Mfg. Co.'s plant in Providence, R. I., averaged 8.9 per cent. Through the adoption of methods to combat this trouble, the company has succeeded in bringing this figure down to an average of 5 per cent.

The plan adopted requires the keeping of accurate and detailed records, the posting of averages, and personal interviews with offending employes. The main points in the plan are, briefly, as follows: Whenever an employe is habitually absent from work, he or she is interviewed by the supervisor of the department. The importance of the job filled is emphasized and the absent person knows that he has been missed. His attention is called to the fact that his machine has been standing idle, that production schedules have been interfered with, and that other equipment besides his own, costing thousands of dollars, may have been tied up. In brief, the real responsibility that he shoulders in these days of urgent production is made clear to him.

If an employe has been absent because of sickness, he is welcomed back; should the occasion warrant it, the necessity for keeping fit may be impressed upon him, and the importance of proper rest and regular living habits may be emphasized.

If the absence of the employe seems unwarranted, however, the supervisor takes a different attitude. He points out that, in effect, the company has entered into a contract with him, and he is expected to do his job. The fact that the company is losing a return on its investment in the equipment he uses, and that the nation is losing urgently needed production, is impressed upon him. The individual responsibility of every employe in maintaining the Army-Navy "E" Award is also referred to.

The company maintains a complete check-up on every employe with regard to whether or not he is present at work when he is expected to be so. Every employe has a card record that shows all absences, the reasons for the absence, and any comments. This careful check-up appears to have been the most important factor in bringing down the percentage of absenteeism. Every man knows that his record is being kept and watched, and that if it is unsatisfactory he will have to talk it over with his supervisor.


BROWN & SHARPE EMPLOYEES
WEEK ENDING JUNE 26 ABSENTEEISM
ARE YOU HELPING YOUR DEPARTMENT TO REDUCE LOST TIME DUE TO ABSENTEEISM?
BROWN & SHARPE EMPLOYEES
WEEK ENDING JUNE 26 ABSENTEEISM
ARE YOU HELPING YOUR DEPARTMENT TO REDUCE LOST TIME DUE TO ABSENTEEISM

Bulletin Boards Used at the Plant of the Brown & Sharpe Mfg. Co. to Indicate Rating of Departments in Respect to Absenteeism

Another interesting feature of the plan is the creation of competition between departments. On two large signboards, the company posts the standing of each department, including non-manufacturing as well as manufacturing departments. These charts are mounted on wheeled platforms which are moved around the factory yards and posted for two days at each of the six gates to the plant. The charts showing the averages are changed every two weeks. Generally, the departments that are low on the list make an attempt to show a better rating. The employes of the department who are regular in their attendance take a hand in this matter.

Obviously, any unusual factors are considered in this connection. For instance, in summer, the lowest average for attendance in the manufacturing division is in the foundry. This is due to the hot weather. Some men simply cannot stand the heat continuously day after day in this department.

* * *

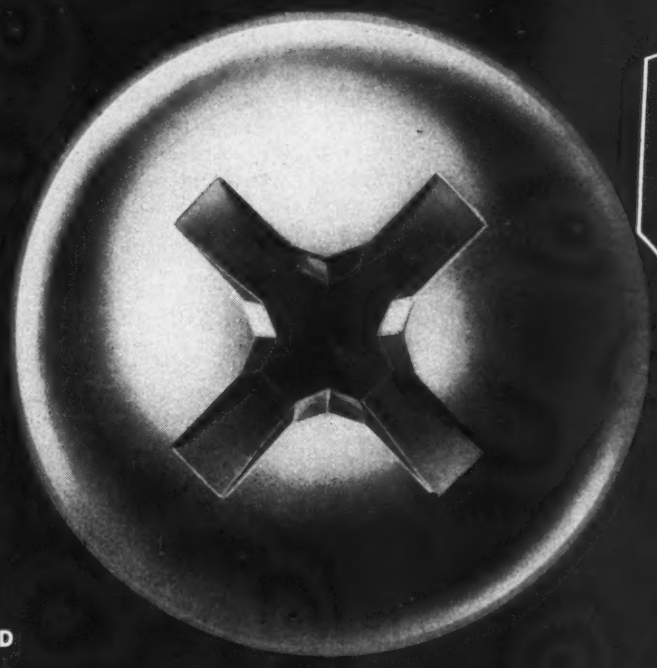
Revere Reports to Its Employes

Under the title "Partners in Revere," Revere Copper and Brass Incorporated makes an annual report to the company's 14,000 employes. In this report, the president of the company, C. Donald Dallas, points out that it takes $8000 of capital to provide a job for every one of the men and women employed.

He further refers to the fact that while last year shipments were the largest in the history of the organization and the total income greater than ever before, so were expenses; and the taxes were the highest ever paid. The amount left over after expenses and taxes were paid was less than 1.5 per cent of the total income.

The report covers forty-eight pages, and is illustrated with photographs and charts. The company believes that it is highly important to keep employes correctly informed on the main facts relating to the conduct of a business, and that a comprehensive report of this kind is the best means of conveying such information. It would undoubtedly create much better feeling throughout industry if this were more generally done.

IT MUST BE RIGHT!



21 Leading Makers of Screws recommend the PHILLIPS RECESSED HEAD

WOOD

MACHINE

SELF-TAPPING

STOVE

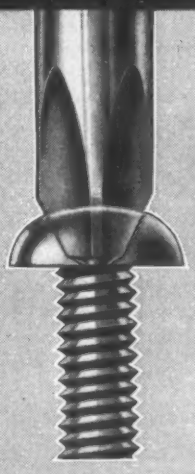
21 Concerns Offer the Phillips Head

AMERICAN SCREW CO. . . . . . *Providence, R. I.*
THE BRISTOL CO. . . . . . *Waterbury, Conn.*
CENTRAL SCREW CO. . . . . . *Chicago, Ill.*
CHANDLER PRODUCTS CORP. . . . . . *Cleveland, Ohio*
CONTINENTAL SCREW CO. . . . . . *New Bedford, Mass.*
THE CORBIN SCREW CORP. . . . . . *New Britain, Conn.*
THE H. M. HARPER CO. . . . . . *Chicago, Ill.*
INTERNATIONAL SCREW CO. . . . . . *Detroit, Mich.*
THE LAMSON & SESSIONS CO. . . . . . *Cleveland, Ohio*
THE NATIONAL SCREW & MFG. CO. . . . . . *Cleveland, Ohio*
NEW ENGLAND SCREW CO. . . . . . *Keene, N. H.*
THE CHARLES PARKER CO. . . . . . *Meriden, Conn.*
PARKER-KALON CORP. . . . . . *New York, N. Y.*
PAWTUCKET SCREW CO. . . . . . *Pawtucket, R. I.*
PHEOLL MANUFACTURING CO. . . . . . *Chicago, Ill.*
READING SCREW CO. . . . . . *Norristown, Pa.*
RUSSELL BURDSALL & WARD BOLT & NUT CO. . . . . *Port Chester, N. Y.*
SCOVILL MANUFACTURING CO. . . . . . *Waterville, Conn.*
SHAKEPROOF INC. . . . . . *Chicago, Ill.*
THE SOUTHINGTON HARDWARE MFG. CO. . . . . . *Southington, Conn.*
WHITNEY SCREW CORP. . . . . . *Nashua, N. H.*

Out of the many screw heads designed through the years to eliminate screw driving troubles, *only* ONE has gained wide approval by the men who should know most about screws... the men who develop and produce fastening devices.

It is highly significant that the leaders in the screw industry . . . *21 concerns* . . . recommend the PHILLIPS RECESSED HEAD as the first recessed head that is *right* in every respect! It assures you that screw driving troubles will be ended when you specify PHILLIPS. Also, it means convenience in buying, and prompt and capable service.

PHILLIPS *Recessed Head* SCREWS



KEY TO FASTENING SPEED AND ECONOMY

The Phillips Recessed Head was scientifically engineered to afford:

Fast Starting – Driver point automatically centers in the recess . . . fits snugly. Screw and driver "become one unit." Fumbling, wobbly starts are eliminated.

Faster Driving – Spiral and power driving are made practical. Driver won't slip out of recess to injure workers or spoil material. (Average time saving is 50%.)

Easier Driving – Turning power is fully utilized by automatic centering of driver in screw head. Workers maintain speed without tiring.

Better Fastenings – Screws are set-up uniformly tight, without burring or breaking heads. A stronger, neater job results.

WOOD SCREWS • MACHINE SCREWS • SELF-TAPPING SCREWS • STOVE BOLTS

It is Easy to Forget Costs

In a publication known as "Trundle Talks," George T. Trundle, Jr., of the Trundle Engineering Co., Cleveland, Ohio, deals, from time to time, with some of the important, but not always obvious, problems facing industry.

In a recent issue, Mr. Trundle says: "I don't think I am exaggerating in the least when I say that if industry, by and large, is as lax in watching its costs after the war as it is today, many companies in this country will be headed toward bankruptcy.

"This isn't a question of lack of good intent, or of carelessness, or disregard for sound operation. It is simply inherent in the nature of the war picture. The company stays in business just the same, whether costs are high or low. What is completely lacking is the desperate spur of peacetime competition, wherein a manufacturer must get his costs down 'or else.'

"In normal times, cost-watching is done with an eye toward profits. But in wartime, most of a company's profits are syphoned off in taxes, and the balance in renegotiation—and *the most efficient companies are the ones that are penalized the most.*

"How can we expect to regain, throughout our industrial system, the proper respect for the taxpayer's dollar when there is no reward for economy? The attitude is: 'Spend the money—you can't keep it anyway.' It amounts, in fact, well nigh to putting a premium on inefficiency."

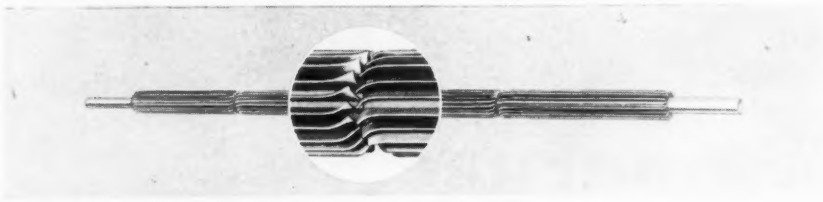
Mr. Trundle points out, however, that while industry and business may have been extravagant under present conditions, the waste of dollars by our Government, through sheer extravagance and inefficiency, is tremendous. Says Mr. Trundle: "There has been money for bureaus and for reports, for questionnaires—with carbon copies filed God-knows-where—for clerks who didn't know what they were supposed to do or why, and for people compiling statistics on something they knew nothing about, with no guess as to any purpose that might be made of the so-called facts they found.

"Today, in Washington—just as in industry—we should have some general idea of where we are going. We should begin to know what is needed and what is not needed. We should be able to separate that which is unnecessary and political from that which is necessary and essential to the prosecution of the war.

"Isn't it time this separation was made? Isn't it time at long last that Government, as well as industry and business, took stock, reviewed operations, showed some respect for the dollar, and said, *'What should it cost?'*"

New Design of Fintubes for Increasing Heating Efficiency

The Brown Fintube Co., 160 Filbert St., Elyria, Ohio, has recently added a new type of heat transferring tube to the resistance-welded integrally bonded Fintubes which it manufactures. One lineal foot of a regular Fintube is said to provide the heat transferring capacity of from 6 to 10 feet of plain bare tubes. The new Fintubes, with cut and twisted fins, are said to provide much greater turbulency effects than those that have straight untwisted fins, thus producing increased thermal efficiency ranging up to 50 per cent in the case of sectional hairpin and other types of heat exchange units in which the shell side is held closely against the Fintubes. This results in a further saving in weight, pressure drop and shipping costs.



"Cut and Twisted" Fintube Designed to Increase Heating Efficiency

Army-Navy "E" Awards

The Army-Navy "E" Award has recently been presented to the following concerns in the machine-building and allied industries for excellence in production:

Automotive Maintenance Machinery Co., North Chicago, Ill.

Bristol Co., Waterbury, Conn.

Cannon Electric Development Co., Los Angeles, Calif.

Carborundum Co., Niagara Falls, N. Y.

Dow Chemical Co., Great Western Division, Pittsburg, Calif.

Eastern Rolling Mill Co., Baltimore, Md.

General Electric Co., Pittsfield Works, Pittsfield, Mass.

LeTourneau Co. of Georgia, Toccoa, Ga.

* * *

Refrigeration of Coolant for Grinding Increases Production

By chilling the coolant used in high-speed grinding, the McCrosky Tool Corporation, Meadville, Pa., has been able to increase the production of grinding machines. According to J. C. Tweedell, field manager for the York Corporation, manufacturer of refrigerating equipment, the chilling of the coolant enables the grinding machines to be operated continuously.

The system is designed to maintain a constant temperature of 60 degrees F. of the grinding coolant, using a York self-contained cold-well water-cooler. Prior to the installation of this system, it is said that, on surface grinders, the coolant temperature would rise from 80 to approximately 150 degrees F. in from one to two hours, making it necessary to shut down the machines temporarily.

* * *

How to Prepare an Engineering Report

A 72-page guide entitled "How to Prepare an Engineering Report" has been published by the Alexander Hamilton Institute, 71 W. 23rd St., New York, 10, N. Y. This booklet, as well as one entitled "Forging Ahead in Business," is available without charge by writing the Institute.

Yes WE DELIVER ON TIME

No holding up vital jobs while you wait for your grinding wheels or mounted wheels*.

Timing and scheduling are everything now. That's why our streamlined QUICK SERVICE is such an important asset.

Fully approved and endorsed by W P B, here's our war-time speed setup:

- Manufacture only wheels 3" in diameter and under. To speed production, larger sizes are eliminated for the duration.
- No quitting whistle. We are on the job making wheels 24 hours a day, every day.
- Our central location brings us closer to many plants. No time lost in transfer connections or long distance shipping.

ICA

The wheels of proved quality—known for performance, cutting and long life.

Any shape, grain and grade, any size up to 3" in diameter. From this army of wheels you can select one custom built for your job.

AMERICA'S HEADQUARTERS FOR MOUNTED WHEELS

*Half a century of specialization has established our reputation as the Small Wheel People of the Abrasive Industry You can bank on us.

TRY ONE—Tell us the kind of equipment, the job, and size wheel you want to try. We'll send it postpaid.

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CHICAGO WHEEL & MFG. CO.

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Interested in
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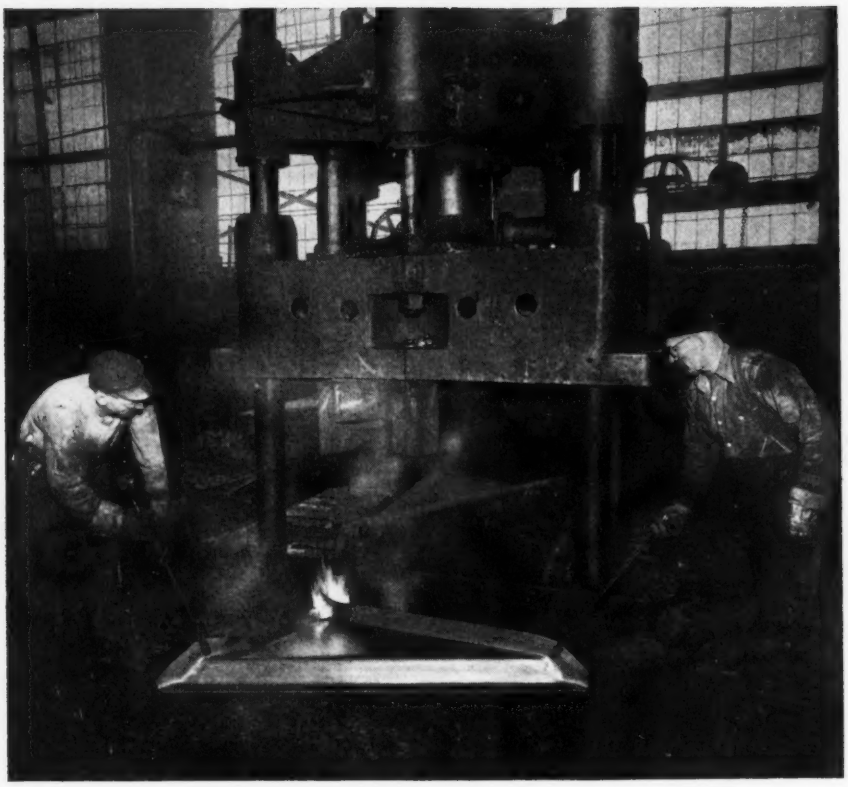

Using a 350-ton Hydraulic Press for Forming Inside Hopper Sheets for Coal Cars from Steel Stock that has been Preheated to 1600 Degrees F.

Forming Hopper Sheets for Coal Cars

A considerable variety of parts required in building coal cars at the Huntington, West Va., Works of the American Car and Foundry Co. are formed from hot steel plate by means of the 350-ton hydraulic press here illustrated.

The particular operation shown consists of bending inside hopper sheets from 1/4-inch thick steel, heated to about 1600 degrees F. The irregular shape is obtained within the specified dimensions by the use of a heavy punch and die. The punch is made with four vertical extensions, which are machined to fit guide blocks on the sides of the die and thus insure correct sidewise and endwise alignment of the punch and die. Side stakes are among the other car parts formed with this equipment.

Building a 20-Ton Crane from Scrap

A heavy-duty, 20-ton overhead crane was recently built from scrapped and salvaged parts by the Oakland Maintenance Division of the General Metals Corporation, Oakland, Calif. By constructing the crane in this way, an eighteen months' delay in obtaining a vitally needed crane was avoided. The unit was completed in three months from salvaged and scrapped parts gathered from many sections of the country.

The overhead beams or girders, for example, were located in an old power house, some hundreds of miles out of Salt Lake City, in a plant abandoned by the Utah Power & Light Co. for many years. A Westinghouse motor was salvaged from a deserted rock quarry in Nevada. This motor supplies power for the bridge. Power for the hoist is furnished by a General Electric motor salvaged from a damaged crane at Shasta Dam in northern California. Another electric motor was found in a lumber mill in the state of Washington, and now provides power for the trolley drive. The hoist brake was salvaged from an old gold mine hoist in Angels Camp, Calif. All of this indicates what enterprise will accomplish.

New Type Oil Reconditioner

An oil-treating unit has recently been developed by the Sparkler Mfg. Co., 332 Lake St., Mundelein, Ill., which is a complete oil-treating, filtering, and reconditioning machine, especially designed for reconditioning cutting, grinding, and honing oils that should be heated before filtering.

Many of these oils must be filtered carefully, in order to remove very small metal particles. If this is done at room temperature, some of the components of the oils, such as sulphur, lard, wax, etc., are said to be removed also, thereby impairing the quality of the oil; but if the oils are heated to a temperature of from 170 to 200 degrees F., these substances are not filtered out. Furthermore, heating tends to sterilize the oil and thereby prevents dermatitis. This equipment can be moved about from place to place, being mounted on ball-bearing casters.

* * *

New Development in Extruded-Tube Equipment

A new method of design incorporated in extrusion presses built by the Schloemann Engineering Corporation, 1154 Empire Bldg., Pittsburgh, Pa., is said to permit the production of extruded tubes of uniform wall thickness without frequent readjustment of tools and machine. The method used permits the expansion and contraction of the platen and container holder in all directions without losing alignment with the center line of that part of the machine that carries the press stem.

* * *

Gear Production Still Rising

The gear manufacturing industry, as represented by the members of the American Gear Manufacturers Association, Empire Bldg., Pittsburgh, Pa., shows an increase of 17 per cent in the business booked in June—the last month for which statistics are available — as compared with May. This report does not include turbine or propulsion gearing.

"MORE PRODUCTION, BETTER FINISH, REJECTS ELIMINATED—Grinding Airplane Cylinder Valve Seats"

writes

POR-OS-WAY'S WAR PLANT REPORTER

Dear Charlie:

I'm writing this from the [redacted] plant, and here's more bad news for the Axis.

The use of Por-os-way is producing one additional airplane barrel, with valve seats precision-ground, every working hour. Multiply that one out, and you can see that Por-os-way's got something — something that the Axis doesn't like.

So long 'til next report

Your roving reporter

"Vic"

THE JOB:
Removing .010" to .012" from valve seats of airplane cylinder barrels on a Waddell Valve Seat Grinder—wet grinding at 5,000 R.P.M.

THE WHEEL:
Por-os-way 3¼" x ⅞" x 1⅛" C80 HV3.

All facts and figures given are taken from an actual field survey made by a Por-os-way correspondent.

WRITE for complete booklet "Facts About Por-os-way". The address is 428 Wheatland St., Phoenixville, Pennsylvania.

THE RECORD	POR-OS-WAY	FORMER WHEEL
Pcs. per Hour (2 Seats per Cylinder Barrel)	5*	4
Dressings	None	3 per wheel
Pcs. Per Wheel	300-375	120-150
Life of Wheel	1½ days	1 day
Average Depth of Cut	.005"—.008"	.001"—.003"
Rejects	None	2%
Finish	Superior	———

*Conservative. Por-os-way has proved ability to grind 8 pcs. per hour, or 100% more than former wheel.

Remarks (by foreman). "My men take pride in their work. If a wheel is too hard and burns work, it means lost time and material and gets them sore. We are sold on the merits of Por-os-way."

2 TO 5 TIMES MORE WAR PRODUCTION PER MAN PER MACHINE

POR-OS-WAY*

a new

RADIAC* PRODUCT

A. P. DE SANNO & SON, INC.
NEW YORK, CHICAGO, PITTSBURGH, CLEVELAND, DETROIT, LOS ANGELES

PHOENIXVILLE, PENNA.
Western Gateway to VALLEY FORGE

*T. M. Reg. U. S. Pat. Off.

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Uses of Sintered Silver Increasing

According to information supplied by Handy & Harman, New York City, now directing the American Silver Producers' Research Project, the use of silver in powdered metallurgy is increasing. It is employed for making mechanical mixtures containing such metals as nickel, which do not alloy with silver except in small proportions. Graphite, tantalum, molybdenum, and tungsten are among the materials mixed in finely powdered form with silver powder, and compressed and sintered at a temperature slightly below the melting point of silver. Some of the resulting products can be rolled into sheet or drawn into rod, the principal use of which at present is in making electrical contacts and welding electrodes, although other applications are contemplated. Even wire suitable for heading operations is produced, since silver itself is ductile and helps to form ductile mixtures.

* * *

Identifying Welder's Work in Large Plants

In a plant where a number of welders are employed, it is desirable to have an identifying mark on each welded job to indicate who performed the work. The Atlas Welding Accessories Co., 307 Boulevard Bldg., Detroit, 2, Mich., has brought out a symbol hammer and stamps for marking work for identification. As many as 180 different symbol stamps are available.

* * *

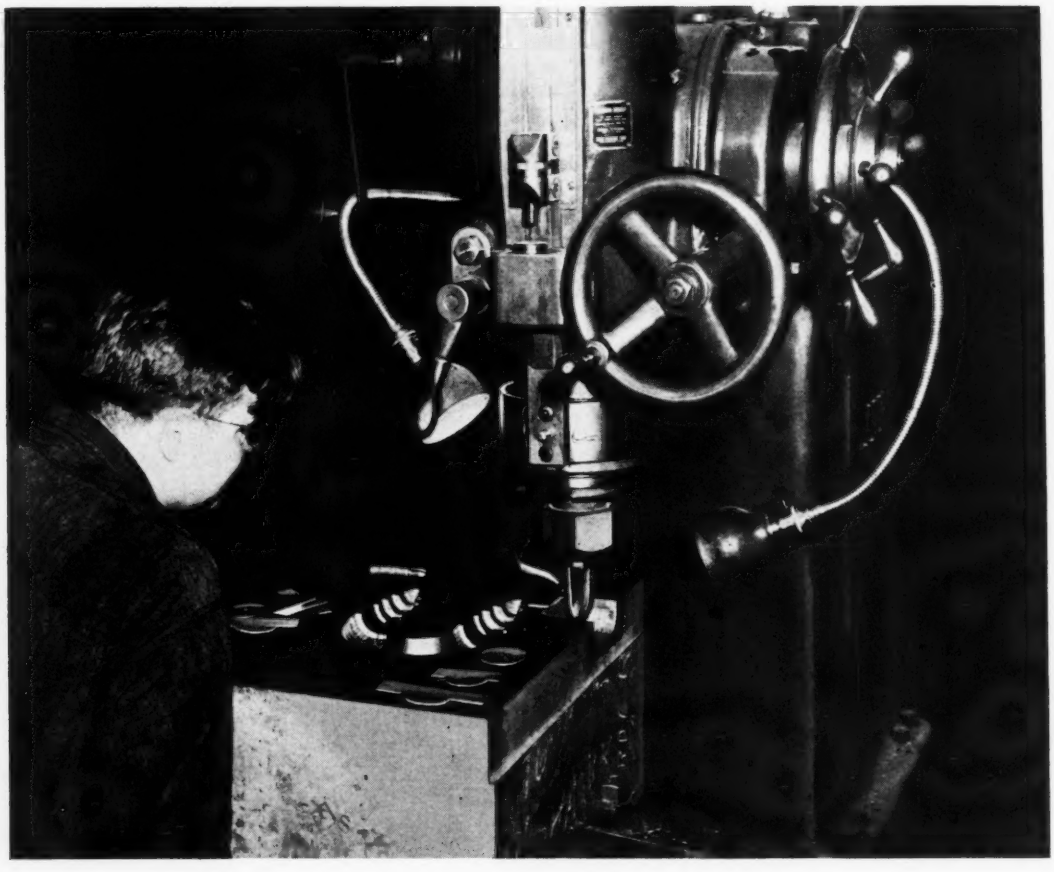
You cannot bring about employment and prosperity by discouraging thrift.

Extruded Shapes Made from Synthetic Rubber

Extruded parts of Ameripol synthetic rubber having a Durometer reading of only 35—five points less hardness than any natural rubber compound formerly extruded by the company—have been produced by the B. F. Goodrich Co., Akron, Ohio. These extruded parts were developed for aircraft application. The new compound is expected to find many other industrial uses, especially where air-tight or liquid-tight seals are required.

* * *

Many machine tool builders who do not now need their entire expanded facilities for building machine tools are taking contracts for war equipment such as Diesel engine, aircraft, and marine engine parts.



Producing a Drop-forge Die for a Male Chain-link Member at the Plant of the Baldt Anchor, Chain & Forge Co. on a Reed-Prentice Vertical Milling and Die-sinking Machine. A Number of Templets Used to Determine whether the Correct Contours of the Impression are being Obtained at Various Points are Seen Lying on the Die-block. A Four-fluted Form Cutter of 1 3/4 Inches Diameter is Used

Of what value are additives in a hydraulic oil?

We like to be asked that question. It gives us an opportunity to go into the whole argument for treated oils—a story that convinces men who examine it carefully.

First we select the best stocks which nature and modern refining can provide. Then we improve on them by scientifically conceived treatment and additions to strengthen them for today's extra-heavy duty.

With treated hydraulic oils, for example, we can prove by carefully kept service records that you get (1) high oxidation stability (freedom from sludging) (2) active solvent properties (3) increased film strength. These advantages mean smoother running machines, less frequent change of oil, clean systems.

To demonstrate practically what science has done for hydraulic oils we are ready to check and test with you right in your plant without interrupting production . . . ready to show you the list of leading manufacturers who have placed HYDRO-DRIVE processed hydraulic oil on their approved list . . . and ready to prove that oil additives mean longer life for irreplaceable machines. Are *you* ready?

HERE'S A GRAPHIC EXAMPLE OF ADDITIVE VALUE

The following figures represent bona fide tests of a high grade straight petroleum oil used for hydraulic service, as compared to the *same oil* after Houghton processing.

Viscosity change due to oxidation	Original oil	Same oil, Houghton-processed
Original visc. @ 210°F.	47.6	45
Final Visc. after oxidation	51.5	45.9
Final Conradson Carbon value	.59	.20
Acid number change due to oxidation	1.15	.55
Precipitation of naphtha insolubles due to oxidation—Total mg. after 48 hrs.	63	2.4
Transparency—original	200	200
" —final	75	140

The technical booklet on Houghton's HYDRO-DRIVE Hydraulic Oils tells the whole story. Write for it.

E. F. HOUGHTON & CO.
303 West Lehigh Ave., Philadelphia, Pa.
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News of the Industry

California and Oregon

CLIFFORD C. STONE, formerly vice-president and general manager of the Empire Tool Co., Detroit, Mich., has formed a sales organization known as the STONE TOOL CO., to represent the Empire company as exclusive distributor in the territory west of the Mississippi and in the southeastern states east of the Mississippi. The office of the Stone Tool Co. will be located in Los Angeles, Calif.

EARLE M. JORGENSEN CO., 10510 S. Alameda St., Los Angeles, Calif., distributor of Timken graphitic steel in Texas and Oklahoma, will also handle the sale of graphitic steel in Arizona and southern California. CLAUDE M. LIVERMORE, long identified with West Coast tool steel distribution, has recently become associated with the Jorgensen organization.

S. R. KALLENBAUGH has been appointed West Coast district manager of the Steel and Tube Division, Timken Roller Bearing Co., Canton, Ohio, with offices at 1526 S. Olive St., Los Angeles, Calif. Mr. Kallenbaugh has been metallurgical service representative for the Timken organization in Cleveland and Detroit.

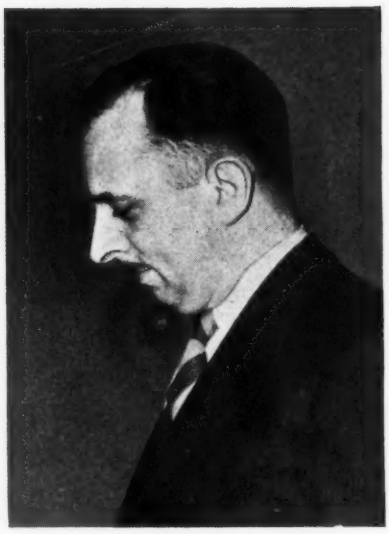
J. S. WISE has been appointed West Coast representative of the Aircraft Screw Products Co., Inc., Long Island City, N. Y., manufacturer of the "Aero-Thread" screw thread system and "Heli-Coil" inserts for tapped threads. Mr. Wise's office will be located in the Title Guarantee Bldg., Los Angeles, Calif.

BENCHMASTER MFG. CO., 2952 W. Pico Blvd., Los Angeles, 6, Calif., is the new name adopted for the company formerly known as DURO MFG. CO., manufacturer of bench machine tools, including punch presses and vertical milling machines.

W. B. MORROW has been appointed personnel manager of the Willamette Hyster Co., Portland, Ore. Mr. Morrow has been with this organization since 1939 in various capacities, including accounting and personnel work.

Illinois, Indiana, and Missouri

G. L. CHRISTIANSON has been appointed assistant to the general manager of the Rockford Drilling Machine Division of the Borg-Warner Corporation, Rockford, Ill. He has been associated with the Rockford Drilling Machine



G. L. Christianson, Newly Appointed Assistant to General Manager, Rockford Drilling Machine Division, Borg-Warner Corporation

organization for seventeen years. Prior to his new appointment, he managed the factory sales department, which now handles orders for marine, aircraft, and army vehicle parts, as well as agricultural equipment.

JOHN EASTON has been appointed director of the development and standardization activities of the Whiting Corporation, Harvey, Ill. Mr. Easton was born in Scotland and graduated

Earl L. Ramsey, Recently Appointed to the Staff of the War Production Board

from the University of Edinburgh with the degree of mechanical engineer. When he came to America, he was first connected with the Chrysler Corporation, and later with several aircraft companies in various engineering capacities.

HAROLD D. KELSEY has been appointed assistant to the manager in charge of engineering at the Fort Wayne Works of the General Electric Co. Mr. Kelsey has been in the employ of the company since 1920, when he graduated from Syracuse University.

DIAGRAPH-BRADLEY STENCIL MACHINE CORPORATION, St. Louis, Mo., celebrates its fiftieth anniversary this year. At present, the company's production of essential equipment is five times the pre-war peace production.

Michigan

L. A. CLARK, formerly with Holden, Graham & Clark, is now vice-president of Florez, Phillips & Clark, 815 Bates St., Detroit, Mich., a newly organized advertising and marketing agency. The new agency will operate as a division of the Visual Training Corporation, and will include among its principals G. A. FLOREZ, president and founder of the Visual Training Corporation, and C. S. PHILLIPS, formerly with the John Bean Co., Lansing, Mich.

COLONIAL BROACH CO., Detroit, Mich., is celebrating its twenty-fifth anniversary this year. In connection with the event, the company has published a 16-page, three-color booklet entitled "A Quarter Century of Broaching Development." The booklet emphasizes the tremendous growth of broaching in the last twenty-five years.

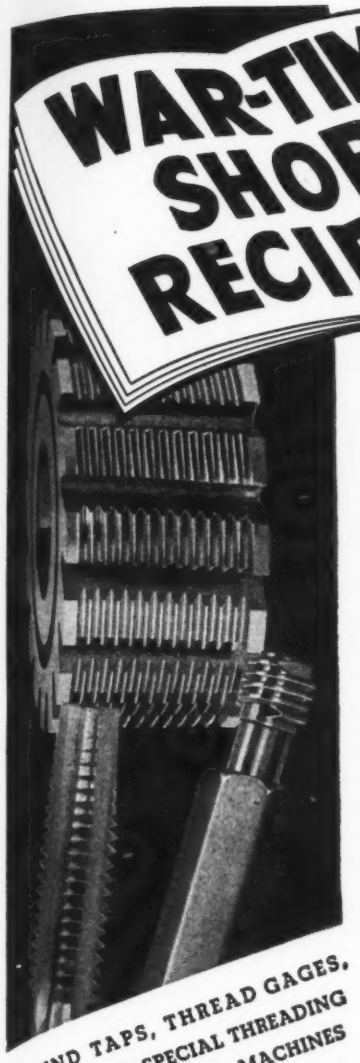
EARL L. RAMSEY, manager of the Diesel Division of the Ex-Cell-O Corporation, Detroit, Mich., has joined the staff of the War Production Board at Washington in the Automotive Division. Mr. Ramsey has been associated with the Ex-Cell-O organization for seventeen years.

DAN SCHAITBERGER has been appointed sales manager of the Northern Engineering Works, Detroit, Mich., crane and hoist manufacturers. He has been with the company for the last sixteen years.

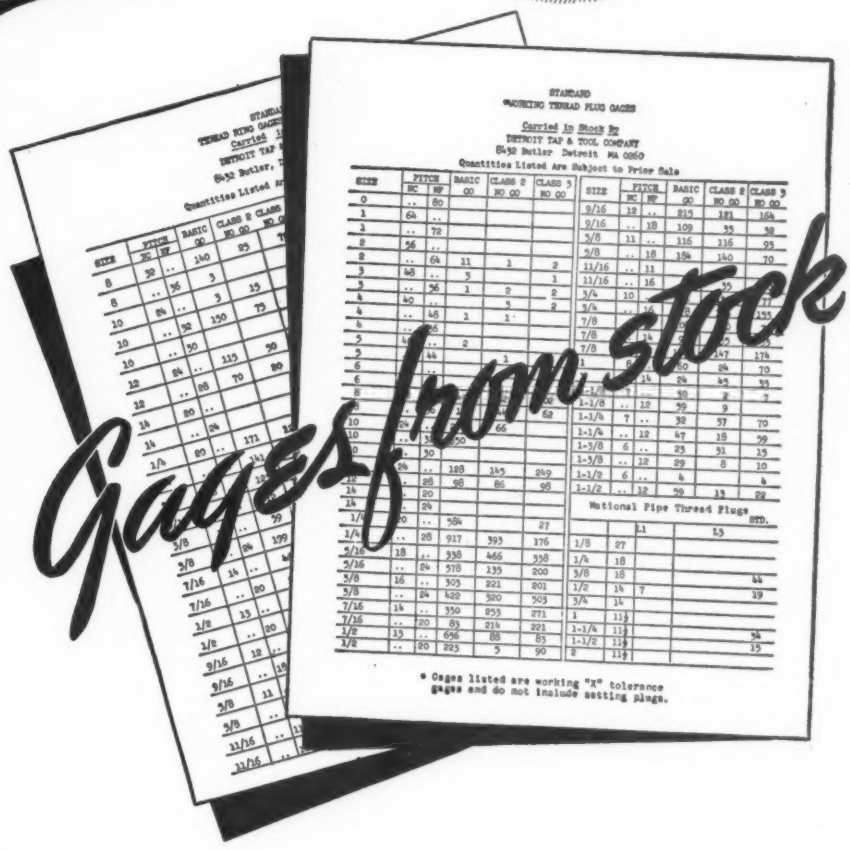
GEORGE D. SHAEFFER has been appointed chief engineer of the engineering departments of Gar Wood Industries, Inc., Detroit, Mich.

WAR-TIME SHOP RECIPES

#5 for thread production



GROUND TAPS, THREAD GAGES, THREAD HOBS & SPECIAL THREADING TOOLS. SPECIAL TAPPING MACHINES


STANDARD
WORKING THREAD PLUG GAGES
Carried in Stock By
DETROIT TAP & TOOL COMPANY
8432 Butler Detroit MA 0260
Quantities Listed Are Subject to Prior Sale
National Pipe Thread Plugs
* Gages listed are working "X" tolerance gages and do not include setting plugs.

Gages from stock

Need some particular thread gages in a hurry? Here's your best bet: *Every two weeks* Detroit Tap issues to its field representatives lists showing sizes and quantities of standard thread gages available from stock in Detroit. Chances are your size may be readily available. It only takes a phone call to find out. Pick the nearest one from those listed below:

CHICAGO	KEdzie 3170	PITTSBURGH	MAyflower 3177
CLEVELAND	HEnderson 6113	ROCKFORD	MAin 2243
DETROIT	MAdison 0260	ST. LOUIS	CEntral 4435
DENVER	KEystone 7229	ST. PAUL	GArfield 4341
FLINT	FLint 4-2624	SYRACUSE	SYracuse 8-1462
HOUSTON	CApitol 5634	TOLEDO	GArfield 8017
INDIANAPOLIS	RIley 9393	**IN CANADA**	
LOS ANGELES	KImball 9111	MONTREAL	MArquette 5346
MILWAUKEE	DAly 4256	TORONTO	WAverly 2688
NEWARK, N. J.	MArket 3-1493	WINDSOR	WIndsor 4-9229

Perhaps you would like to receive copies of these gage stock lists regularly? Make a phone call today, or write:

DETROIT TAP & TOOL CO.

8432 BUTLER STREET, DETROIT, MICHIGAN, U. S. A.

New England

L. HERES DEWYK & Co., consulting engineers and manufacturers' agents, have purchased the Gardner Bldg., Ansonia, Conn., where the organization will occupy larger and more convenient quarters to accommodate its growing business.

R. H. HATHAWAY, formerly assistant chief engineer for Hammond Machinery Builders, has joined the Packer Machine Co., Meriden, Conn., as sales and service engineer.

G. W. THOMSON has been appointed abrasive engineer for the Norton Co., Worcester, Mass., covering the territory of Oklahoma, Arkansas, western Tennessee, and the northern parts of Texas, Louisiana, and Mississippi. HENRY L. LEMAY, of the sales engineering department at Worcester, will take over Mr. Thomson's former territory in northern Illinois.

New Jersey

TRACY LANGDON has resigned from the D. A. Stuart Oil Co., Chicago, Ill., to become an executive of the American Oil & Supply Co., Newark, N. J. Mr. Langdon was connected with the D. A. Stuart Oil Co. for twenty-three years, the last fourteen of which he served in the capacity of vice-president.

FRANK SHUGERT has been appointed director of industrial relations for the Elastic Stop Nut Corporation of America, Union, N. J. Mr. Shugert was formerly industrial relations director for the Ranger Aircraft Engine Division of the Fairchild Aircraft Co.

C. H. Linder, New Assistant Manager of the Schenectady Works of the General Electric Co.

JOHN B. LAWSON has been elected vice-president of the Ferracute Machine Co., Bridgeton, N. J. Mr. Lawson has been with the company as controller since September, 1941.

New York

C. H. LINDER has been appointed assistant manager of the Schenectady Works of the General Electric Co. He is a graduate of the University of Texas, having the degree of master of science in electrical engineering. He has been with the General Electric Co. since 1924, and has been assistant to the works manager since June 1, 1942. F. T. LEWIS has been appointed assistant to the works manager of the Schenectady Works. Mr. Lewis entered the employ of the company in 1916 as an apprentice. Later, he attended Tufts College, from which he graduated in 1922, after which he returned to the General Electric Co. Since 1940, Mr. Lewis has been production manager at the West Lynn Works.

F. T. Lewis, Assistant to Works Manager of the Schenectady Works, General Electric Co.

DR. RUDOLF G. MINARIK, Appleton, Wis., chief designer and consultant on mechanical design for the Kimberly-Clark Corporation, has been appointed professor of mechanical engineering in the College of Applied Science, Syracuse University.

LESTER D. CHIRGWIN, general manager of the Buffalo plant of the Farrel-Birmingham Co., Inc., has been elected a director of the company. Mr. Chirgwin started working for the Farrel-Birmingham organization in 1909 as an office boy. In 1911, he entered Yale University, graduating in 1914 with the degree of mechanical engineer. He then re-entered the employ of the Farrel-Birmingham Co., with whom he has been connected since, except for a brief period during the first World War. He became general manager of the Buffalo Division early this year.

Lester D. Chirgwin, Newly Elected Director of the Farrel-Birmingham Co.

CHARLES A. SIMMONS, SR., president of the Simmons Machine Tool Corporation, Albany, N. Y., has gone to South America for the purpose of investigating the possibility of establishing a machinery rebuilding plant in Brazil and to act in an advisory capacity to the United States Navy in connection with arsenals and machine shops at our bases in Brazil and Peru. Since the start of the Defense Program in 1940, Mr. Simmons has been in Washington in an advisory capacity.

KENNETH F. CRAMER has been appointed district manager of the New York office of the Baldwin Locomotive Works, Philadelphia, Pa. Mr. Cramer will direct district sales for all divisions of the company. He has been with the Baldwin organization since 1940.

Ohio

E. M. TASKER, vice-president of the Toledo Stamping & Mfg. Co., Toledo, Ohio, was recently honored with a citation from the U. S. Army Ordnance Department because "by the exercise of his initiative and ingenuity, he has made a marked contribution to the vital war production program to conserve critical material and machines." The achievement specifically consisted of redesigning ordnance parts so that

NEW REEVES *Reducer-Type* TRANSMISSION

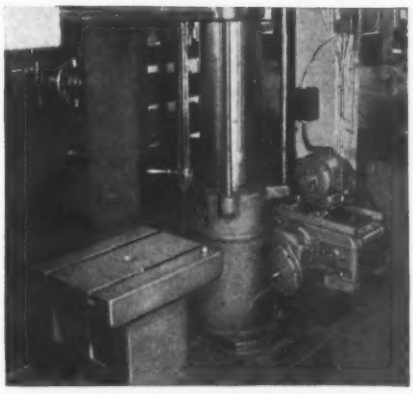
Combines Variable Speed Transmission and Gear Reducer in Single, Compact Unit . . .

● The REEVES Variable Speed Transmission, with built-in speed reducer, meets the many important requirements for accurate variable speed control and speed reduction combined in one compact, completely enclosed unit.

An outstanding advantage of this highly efficient drive is that far less mounting space is needed to obtain the lower output speeds which formerly required use of auxiliary speed reducing equipment.

Available in two enclosed designs —horizontal and vertical—for mounting in any convenient position. Each design is available in wide range of speeds and in capacities from 1 to 7½ horsepower inclusive. The Transmission in various sizes provides ratios of speed variation from 2:1 through 12:1, and the reduction gears provide ratios up to and including 6.9:1.

Either horizontal or vertical design may be equipped for individual motor drive by use of a REEVES motor base. Motor mounting is directly above Transmission, the motor base being attached to top of Transmission frame. This base is universally adjustable to accommodate any standard make of motor of correct horsepower capacities for any given size of REEVES Reducer-Type Transmission. Send for copy of Catalog M-432, giving complete engineering information.



Horizontal design unit, with motor, direct connected to radial drill press

Vertical design REEVES unit is especially adapted for conditions where floor space is limited.

REEVES PULLEY COMPANY • COLUMBUS, INDIANA

REEVES *Accurate Variable* Speed Control

two stampings, hydrogen-brazed together, take the place of solid forgings. The Pressed Metal Institute, working closely with the Ordnance Department on production problems, states that the new method saves sufficient steel to make 640 machine guns of 0.30 caliber, for every 10,000 parts stamped instead of forged.

OHIO CRANKSHAFT CO., Cleveland 1, Ohio, announces the appointment of the following sales agents for Tocco induction heating and hardening equipment: STRONG, CARLISLE & HAMMOND Co., Cleveland, Ohio (northern Ohio territory); SYRACUSE SUPPLY Co., Syracuse, N. Y. (New York State); WM. K. STAMETS Co., Pittsburgh, Pa. (western Pennsylvania, parts of Ohio, and West Virginia); E. A. KINSEY Co., Cinnati, Ohio (southern Ohio, southern Indiana, Tennessee, and Kentucky); and R. R. STEPHENS Co., St. Louis, Mo. (southern Illinois, Missouri, and adjoining territory).

DOW CHEMICAL Co., Midland, Mich., has opened an office in Cleveland, Ohio, on the twenty-third floor of the Terminal Tower Bldg. This office will serve Cleveland, Pittsburgh, Buffalo, Toledo, Cincinnati, Dayton, Columbus, Akron, and Detroit. D. T. WELLMAN, formerly of the sales department at Midland, Mich., will be head of the Cleveland organization.

CLEVELAND AUTOMATIC MACHINE Co., Cleveland, Ohio, builder of automatic screw machines and single-spindle automatics, has added a line of high-pressure hydraulic die-casting machines with the purchase of the G & N MFG. Co., also of Cleveland. Both the manufacture and sales of the die-casting machines will be handled at the Cleveland Automatic Machine Co.'s plant at 2269 Ashland Road, Cleveland, without interruption of production or deliveries. MILLAR BRAINARD is president of the new G & N Mfg. Division of the Cleveland Automatic Machine Co., and GEORGE A. COLLIER, who has directed Cleveland Automatic sales for several years, is now general sales manager of the combined divisions.

Millar Brainard, President of the G & N Mfg. Division of the Cleveland Automatic Machine Co.

George A. Collier, General Sales Manager of Combined Divisions of the Cleveland Automatic Machine Co.

WILLIAM B. CORBETT has been appointed plant engineer, and GEORGE BLUTH general chief inspector of Willys-Overland Motors, Inc., Toledo, Ohio. Mr. Corbett was formerly associated with the Ford, Hupmobile and Chrysler organizations. Mr. Bluth was for fifteen years with one of the divisions of the General Motors Corporation.

HUDSON W. REED, JR., has been appointed director of personnel and safety of the American Welding & Mfg. Co., Warren, Ohio. Mr. Reed became associated with the organization more than a year ago, after turning over the active control of the Reed Iron & Steel Co., of which he was the head, to associates.

FRED E. HARRELL, assistant chief engineer of the Reliance Electric & Engineering Co., Cleveland, Ohio, since 1934, has been appointed chief engineer. Mr. Harrell has been with the organization since 1924, when he graduated from Purdue University.

JOHN B. BARRY has been elected vice-president of Designers for Industry, Inc., Cleveland, Ohio. This company specializes in aircraft product and tool engineering, and industrial design.

Pennsylvania

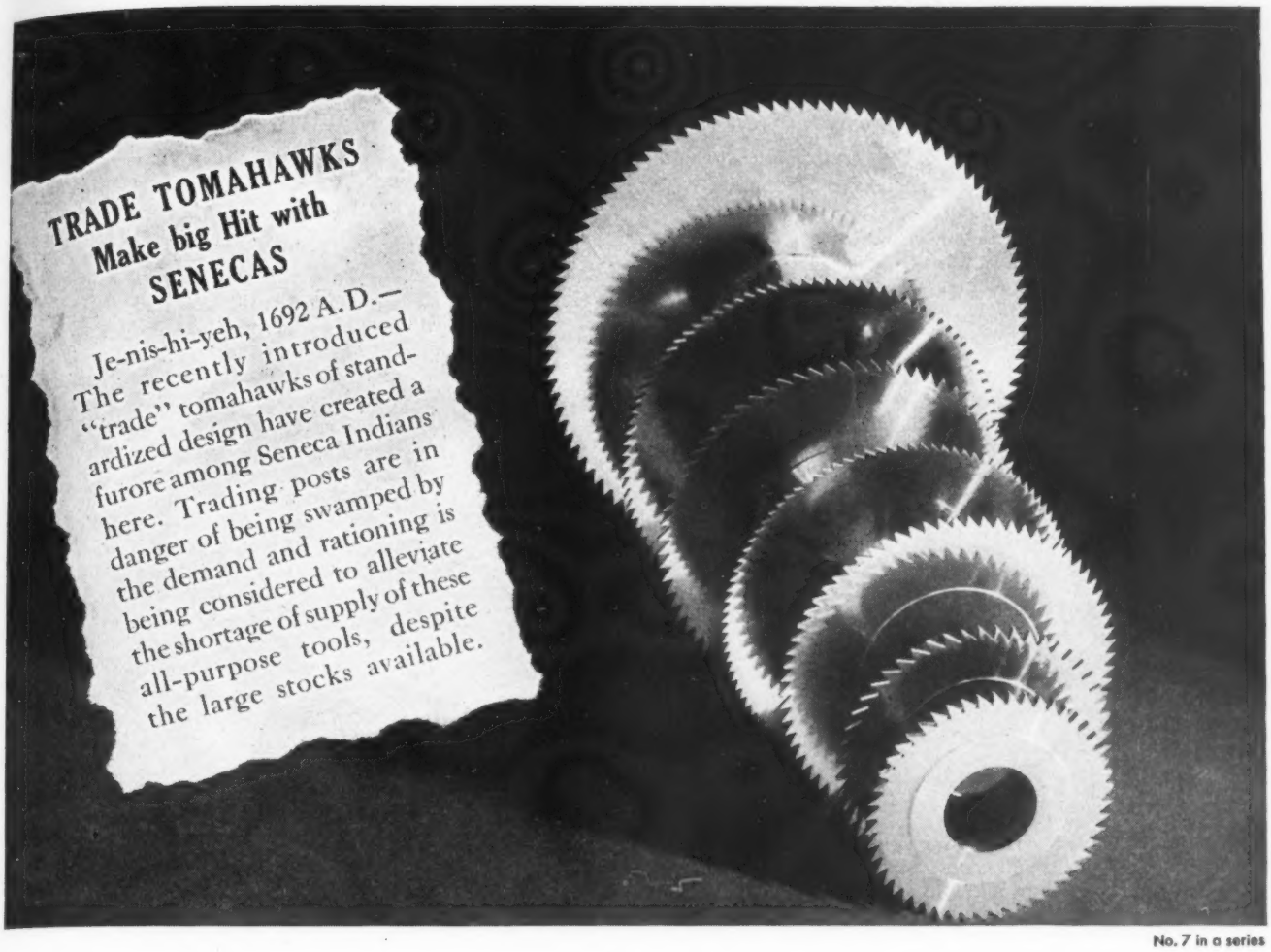
LEROY K. BEHR has been appointed district manager in Philadelphia for the Abrasive Division of the Norton Co., Worcester, Mass., succeeding the late Allan Seymour. Mr. Behr has been with the Norton organization for sixteen years. During the last three years, he has been abrasive engineer for eastern Massachusetts and Maine, with headquarters in Boston. JOHN C. EWER takes over Mr. Behr's former territory.

JAMES J. NELSON has been appointed general manager of the Cramp Brass & Iron Foundries Division of the Baldwin Locomotive Works, Philadelphia, Pa. Mr. Nelson joined the Cramp Brass & Iron Foundries Co. in 1932 as vice-president and sales manager. Later, when the company became affiliated with the Baldwin group, he continued as sales manager of the Cramp Division.

FRED W. PENNINGTON, until recently with the publicity department of the Westinghouse Air Brake Co., has been appointed manager of publications and advertising for Kennametal, Inc., Latrobe, Pa. Mr. Pennington is a past-president of the Pittsburgh Advertising Club, and is now a director of the Pittsburgh chapter of the National Industrial Advertisers Association.

C. L. HUSTON, JR., has been elected president of Lukenweld, Inc., Coatesville, Pa. He is a member of the board of directors of Lukens Steel Co., of which Lukenweld is a subsidiary. Mr. Huston succeeds EVERETT CHAPMAN who resigned to establish his own business as a consulting engineer. He is a graduate of Princeton University, was ten years with the American Roll-

C. L. Huston, Jr., Newly Elected President of Lukenweld, Inc.


TRADE TOMAHAWKS
Make big Hit with
SENECAS
Je-nis-hi-yeh, 1692 A.D.—The recently introduced "trade" tomahawks of standardized design have created a furore among Seneca Indians here. Trading posts are in danger of being swamped by the demand and rationing is being considered to alleviate the shortage of supply of these all-purpose tools, despite the large stocks available.

No. 7 in a series

Standardization—THEN AND NOW

Just as the standardized "trade" tomahawk gave the Indian his first quickly available all-purpose tool so quicker availability of production-standardized **"TOMAHAWK"** tools helped Genesee to grow in only a few years to one of the major tool suppliers to War Production Industry.

Typical is the Genesee line of standardized H.S.S. slitting saws. Saws like those illustrated above are produced in mass production quantities at Genesee, today. They save War Plants precious time when every minute counts.

FOR VICTORY BUY UNITED STATES WAR BONDS AND STAMPS

GENESEE TOOL COMPANY

FENTON, MICHIGAN

Registered Trade Mark

ing Mill Co., Middletown, Ohio, and has been with the Lukens organization since 1939.

H. E. CABLE has been appointed representative in the Pittsburgh territory for the Lincoln Electric Co., Cleveland, Ohio. Mr. Cable, a graduate of the Case School of Applied Science, will assist W. R. PERSONS, Pittsburgh district manager of the company, in informing industry how to apply arc welding effectively.

DAVID M. ATEN has become metal process engineer of the Quaker Chemical Products Corporation, Conshohocken, Pa. Mr. Aten received the degree of master of arts in physics from the University of Michigan in 1932, and has been employed for seven years as lubrication engineer with one of the larger oil companies.

GEORGE R. MURRAY has been elected a vice-president, and EDGAR S. HUTTON a vice-president and a director of the Chambersburg Engineering Co., Chambersburg, Pa., manufacturer of hammers and other forging equipment. Mr. Murray also serves as works manager, and Mr. Hutton as treasurer.

EARL K. CLARK has been appointed manager of the Westinghouse Appliance Engineering Department, and H. R. CUMMINS has been made assistant manager. Mr. Clark has been with Westinghouse for twenty-one years, and Mr. Cummins for eight years.

HARVEY MCKENNEY has been appointed manager of alloy steel sales of the Follansbee Steel Corporation, Pittsburgh, Pa. Mr. McKenney was previously associated with the Carnegie-Illinois Steel Corporation and the Crucible Steel Co. in production work.

ALLEGHENY LUDLUM STEEL CORPORATION, Pittsburgh, Pa., has been awarded the Patriotic Service Cross for its cover design of "Steel Horizons" in the second national magazine flag competition sponsored by the U. S. Flag Association.

WILLIAM B. GRIESE, formerly plant manager of the Liquid Cooled Engine Division, Toledo, Ohio, has been made plant manager of the Spencer Heater Division of the Aviation Corporation, at Williamsport, Pa.

WESTINGHOUSE ELECTRIC & MFG. CO., Merchant Marine Division, Philadelphia, Pa., has been awarded the Maritime Commission's "M" pennant for outstanding achievement in the production of ship propulsion machinery.

MCKENNA METALS CO., Latrobe, Pa., manufacturer of Kennametal products, has been succeeded by KENNAMETAL, INC. The management, personnel, products, and policies will remain the same.

Washington, D. C., and West Virginia

E. K. BURGESS has been appointed assistant sales manager of the Briggs Clarifier Co., 1339 Wisconsin Ave., Washington, D. C. Mr. Burgess, who was formerly factory sales manager for the Nash Motor Co., has been with the Briggs organization for the last two years.

ROBERT W. O'NEAL has joined the Follansbee Steel Corporation, Follansbee, W. Va., and Toronto, Ohio, as industrial engineer in charge of methods and standards.

* * *

American Standards for Flat Sheets and Wire Sizes

In an effort to overcome the difficulty of having a number of different gages for thin flat sheets, a committee organized under the procedure of the American Standards Association in 1941 submitted and obtained approval of an American Standard for thin flat uncoated metals. Later the committee prepared a similar standard for round wire; but due to certain objections raised by manufacturers and users of copper wire, this proposed standard has been tabled for the duration of the war. It is believed by the committee that a great deal could be gained by the general acceptance of a uniform system of wire sizes.

* * *

Automatic Induction Fixture Speeds Sprocket Hardening

The hardening of thirty-six large sprocket teeth in less time than it took by former methods to harden half that number is being done by the International Harvester Co. through the use of an automatic fixture with which a Tocco induction hardening machine is provided. The automatic fixture was designed by the Ohio Crankshaft Co., Cleveland, Ohio, who developed the Tocco process. The fixture holds two sprockets "pancake-wise," hardening two teeth simultaneously. The heating cycle consists of a 10-second heat, a 4-second quench, and a 6-second indexing, or a total of 20 seconds for every two teeth.

* * *

More than 11,000,000 horsepower of steam turbine propulsion equipment will be completed this year by the General Electric Co. for the U. S. Navy and Maritime Commission.

British Machine Tools Produce War Equipment in the United States

It is not generally known that some important British-built machine tools are materially helping to produce war equipment in this country. In one of the General Electric plants, there are five huge machine tools, two of which are planers and the other three gear-hobbing machines of large capacity.

These machines were shipped from Great Britain early in 1942, at a time when it was impossible to get such machine tools from American shops to meet early production requirements. Incidentally, the shipping of these machines to the United States not only aided production here, but also cheated the Axis of a chance to destroy some of these machines, since the plants in which they had been installed, or were about to be installed, in Great Britain were subsequently bombed.

The planers are exceptionally large, one of them being 30 feet wide between housings and 20 feet high under the cross-rail, with a bed 70 feet long. The gear-hobbing machines are also of giant proportions, capable of cutting teeth in gears that weigh as much as 35 tons each.

* * *

Looking toward Future Foreign Business

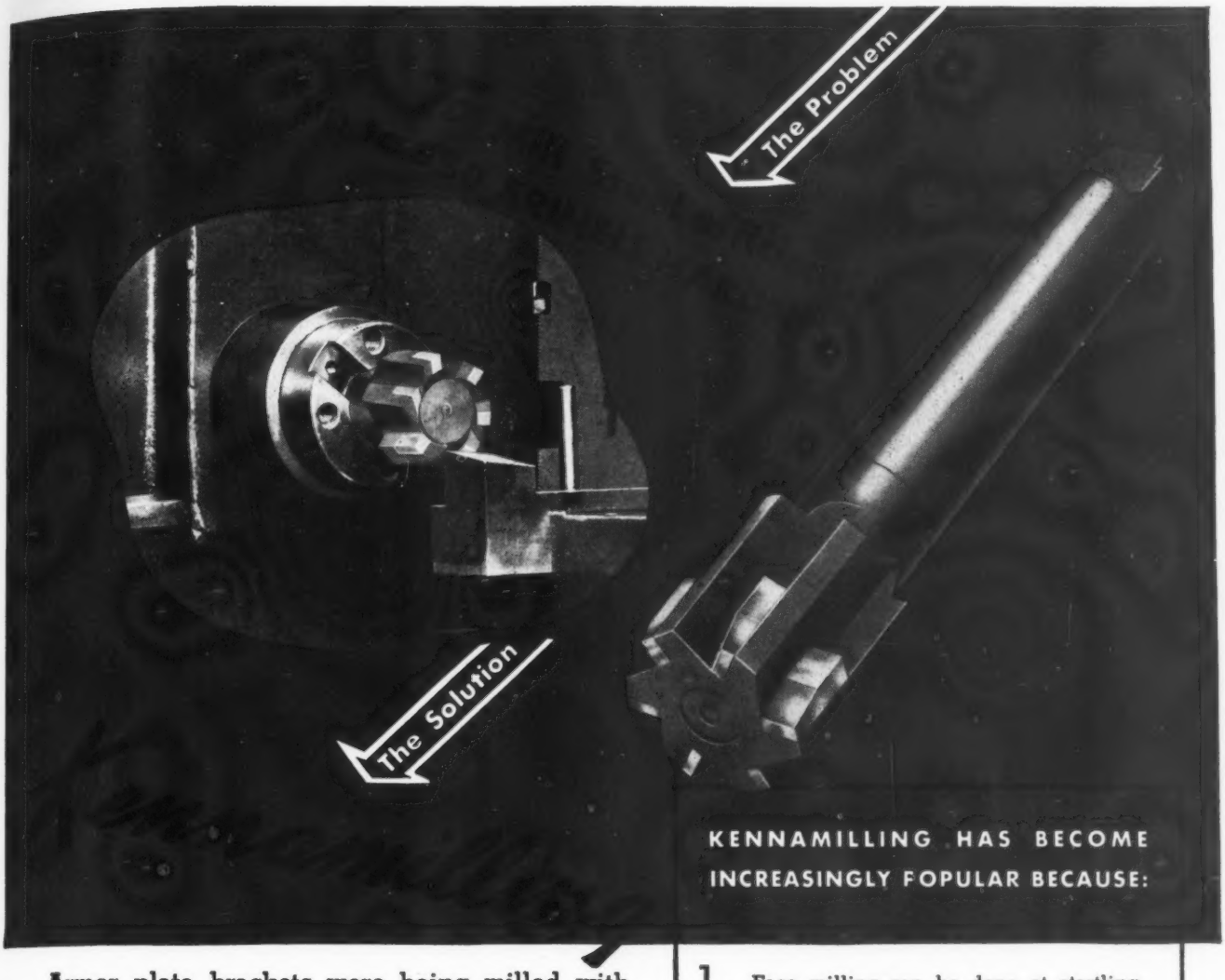
The Cleereman Machine Tool Co., 400 W. Madison St., Chicago, Ill., has published two attractive catalogues—one in Spanish and one in Portuguese—covering the company's drilling machines and jig-boring machines, not only profusely illustrated, but also containing complete descriptive text in the two languages.

* * *

According to estimates of passenger travel on regularly scheduled trains and inter-city buses, 20 per cent of the travel is made up by men and women in uniform on furlough or leave, or traveling individually under orders; 55 per cent is essential civilian travel on war business, personal business, and vacations from work; and 25 per cent is strictly non-essential civilian travel — travel for social purposes, amusement trips, etc. If non-essential civilian travel could be eliminated, it would greatly aid in more efficient handling of the necessary business of the country in wartime.

* * *

You cannot escape the responsibility of tomorrow by avoiding it today.—*Abraham Lincoln*



Armor plate brackets were being milled with high speed steel; only 30 were completed before the high speed steel cutter became dull. A six-bladed home made cutter with 22½° and 67° side cutting edge angle was made, with KENNAMETAL Style 12T50 tools.

The 6-blade, 6″ diameter cutter was run at 80 rpm, 8″ table feed per minute, .016″ feed per tool, and depth of cut 7/16″. 176 brackets were milled through KENNAMILLING before the blades needed resharpening.

KENNAMILLING, sometimes referred to as Hyper-milling or Super-milling, since April 1940 has enabled plants to obtain the greatest possible steel-cutting production on face-milling operations. The strength and hardness of KENNAMETAL steel-cutting carbides now have been combined with the rugged Meehanite bodies of GRAYSON milling cutters to form the GRAYSON-KENNAMETAL shock-resistant milling cutter, designed for maximum production on milling operations on all metals.

1. Face milling can be done at startling speeds.
2. KENNAMILLING permits greater table feeds and greater loads per tooth.
3. KENNAMILLING permits the use of double negative rake angles to produce a very rugged milling cutter.
4. KENNAMETAL'S non-galling properties, hardness, and rupture strength permit milling of High Brinell steels.
5. KENNAMILLING produces precision finishes and is not limited to light cuts.

Write for complete information about KENNAMILLING, the pioneer process of face-milling steels with cemented carbides. KENNAMETAL engineers will assist you in selecting the proper type GRAYSON-KENNAMETAL milling cutter for your particular milling problem.

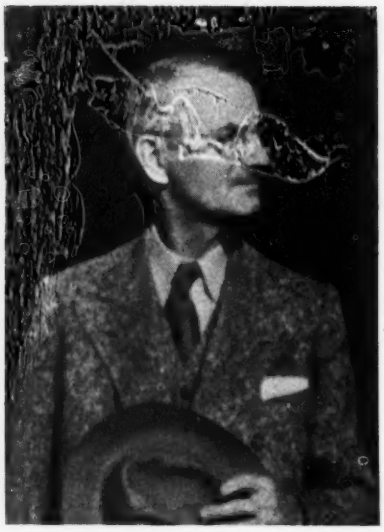
KENNAMETAL Inc.

147 Lloyd Ave., Latrobe, Pa.

Trade Mark Reg. U. S. Pat. Off.

Foreign Sales: U. S. STEEL EXPORT CO., 30 Church St., New York (Exclusive of Canada and Great Britain)

Obituaries



Charles H. Wilkinson

Charles H. Wilkinson, president of Logansport Machine, Inc., and partner and general manager of the Cotner-Wilkinson Co., both of Logansport, Ind., as well as president of the North American Diamond Corporation, Murfreesboro, Ark., died suddenly on July 13, following a heart attack, at the age of fifty-nine years. Mr. Wilkinson was stricken in Cleveland while on a business trip with J. C. Cotner, his partner in the Cotner-Wilkinson Co.

Mr. Wilkinson was born in Belmont County, Ohio, in 1884. After graduating from the Lewis Institute in Chicago, he became associated with the Western Motor Works in Logansport and later joined his father, who was the founder of the Logansport Machine Co. (the name of which was later changed to Logansport Machine, Inc.), in that business. He became president of the company when his father retired in 1936. In 1941, he organized the North American Diamond Corporation, which, at that time, was the only volcanic diamond property in the world outside of South Africa.

Mr. Wilkinson is survived by his widow, a daughter, and three sons, as well as by his father, Frank B. Wilkinson, who is now eighty-seven years of age.

George W. Long

George W. Long, vice-president of the Simmons Machine Tool Corporation, Albany, N. Y., and a member of that firm for over thirty years, was drowned while canoeing on Lake George in New York State on July 22. Mr. Long, who was fifty-one years old, joined Charles A. Simmons shortly after the company was formed in 1910 to handle and rebuild used machine tools.

Mr. Long was known by machine tool builders and users throughout the country. He was exceptionally well informed on all types of machine tools, regardless of age or size. During the last two years, besides his work with the Simmons organization, he was frequently consulted by Army and Navy authorities and gave them assistance in locating critical machine tools.

Mr. Long is survived by his widow, his son, Robert, who is now in the Navy, and a married daughter, whose husband is abroad with the Armed Forces.

JOHN WINTERS UPP, former manager of the General Electric Co.'s Switchgear Division, died at Ardmore, Pa., on August 4, of a heart attack, at the age of seventy-five years. Mr. Upp was born in Sandusky, Ohio. In 1889, he graduated from the electrical engineering course of Cornell University. In 1901, he became connected with the General Electric Co., where he became manager of the Switchgear Division in 1907, a position that he held until he retired in 1933.

FREDERICK PAUL WESSOLEK, general superintendent of the Ohio Crankshaft Co., Cleveland, Ohio, died on July 28 in Cleveland at the age of fifty-six years. Mr. Wessolek was the first employe of the Ohio Crankshaft Co., having been with the company for twenty-three years. He started as a machine operator, and gradually advanced to the positon he occupied at the time of his death.

ALLAN SEYMOUR, for ten years Philadelphia district manager for the Abrasive Division of the Norton Co., Worcester, Mass., died on July 30. Mr. Seymour had been with the Norton Co. for twenty-five years. Previously, he was manager of the Hartford district and head of the sales engineering department at Worcester.

GEORGE A. MOHR, vice-president of the Boye & Emmes Machine Tool Co., Cincinnati, Ohio, died on July 31 in Cincinnati.

CHARLES D. HOGAN, secretary of the United States Electrical Tool Co., Cincinnati, Ohio, died on July 20.

* * *

The worn-out file, once the standby for scraping operations, is being supplanted for that purpose. With the advent of the war and the stress on rapid production, commercial scraping tools tipped with cemented carbide are taking the place of the worn-out file for scraping the surfaces of both iron and steel castings.

Coming Events

SEPTEMBER 30-OCTOBER 2—Joint meeting of the AMERICAN SOCIETY OF MECHANICAL ENGINEERS and the ENGINEERING INSTITUTE OF CANADA at Toronto, Ontario, Canada. C. E. Davies, secretary, 29 W. 39th St., New York City.

SEPTEMBER 30-OCTOBER 2 — Aircraft Engineering and Production Meeting of the SOCIETY OF AUTOMOTIVE ENGINEERS at the Biltmore Hotel, Los Angeles, Calif. John A. C. Warner, secretary and general manager, 29 W. 39th St., New York City.

OCTOBER 5-7—NATIONAL SAFETY CONGRESS in Chicago, Ill. For further information, address National Safety Council, 20 N. Wacker Drive, Chicago, 6, Ill.

OCTOBER 18-21—Twenty-fourth annual meeting of the AMERICAN WELDING SOCIETY at the Hotel Morrison, Chicago, Ill. For further information, address the American Welding Society, 33 W. 39th St., New York City.

OCTOBER 18-22—Annual meeting of the AMERICAN SOCIETY FOR METALS at the Palmer House, Chicago, Ill., in conjunction with the twenty-fifth annual National Metal Congress. W. H. Eisenman, national secretary, American Society for Metals, 7301 Euclid Ave., Cleveland, 3, Ohio.

NOVEMBER 29-DECEMBER 3 — Annual meeting of the AMERICAN SOCIETY OF MECHANICAL ENGINEERS at the Hotel Pennsylvania, New York City. C. E. Davies, secretary, 29 W. 39th St., New York City.

DECEMBER 6-11—NINETEENTH EXPOSITION OF CHEMICAL INDUSTRIES at the Madison Square Garden, New York City. For further information, address International Exposition Co., 480 Lexington Ave., New York City.

JANUARY 10-14, 1944—Annual meeting and engineering display of the SOCIETY OF AUTOMOTIVE ENGINEERS at the Book Cadillac Hotel, Detroit, Mich. John A. C. Warner, secretary and general manager, 29 W. 39th St., New York City.

APRIL 25-28, 1944—THIRD WAR PRODUCTION FOUNDRY CONGRESS and FOUNDRY SHOW of the American Foundrymen's Association, to be held at the Memorial Auditorium, Buffalo, N. Y., in conjunction with the forty-eighth annual meeting of the Association. Executive office, American Foundrymen's Association, 222 W. Adams St., Chicago, Ill.

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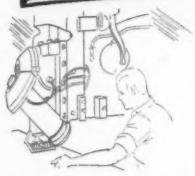

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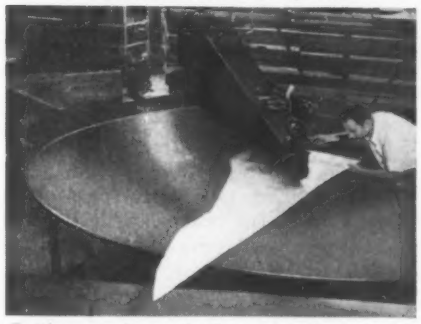

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New Books and Publications

DIMENSIONAL CONTROL. Portfolio of forty large illustrated charts dealing with dimensional control, its theory and its industrial application. 27 by 32 inches, bound between heavy covers. Published by the Sheffield Corporation, Dayton, Ohio. Price, $3.50.

These charts are intended for use in classroom training of inspectors, and are being made available to industry by the Sheffield Corporation, a concern manufacturing gages, precision measuring instruments, and machine tools. Included with the charts is a 28-page booklet outlining an address to be given with the charts and presenting a general review of gaging practice in modern industry. The charts cover basic dimensions, principles of "Go" and "Not Go" gages, wear allowance, gage-makers' tolerances, gaging policies, fixed gages, and precision measuring instruments.

Because of the limited edition, the Sheffield Corporation reserves the right to accept orders based on the amount of use estimated for each set of charts, which is to be indicated on an application form that will be supplied by the corporation. This provision is made because the price set for these charts is nominal, representing less than one-half the actual cost.

BASIC PROBLEMS IN ENGINEERING DRAWING. By William Wirt Turner. Loose-leaf instruction sheets, 8 1/2 by 11 inches, arranged for binder. Published by the Ronald Press Co., 15 E. 26th St., New York City. Price, $1.25.

The author of this set of sheets, who is associate professor and head of the department of engineering drawing of the University of Notre Dame, has included general suggestions for the student, specific working instructions for the individual sheets, forty-two sheets of drawing problems, six practice sheets, and six tracing sheets. The object has been to provide a series of work sheets in engineering drawing that would provide a systematic course of instruction, planned to provide a real grasp of fundamentals and of everyday drafting-room practice.

DICTIONARY OF SCIENCE AND TECHNOLOGY IN ENGLISH, FRENCH, GERMAN, AND SPANISH. By Maxim Newmark. 386 pages, 6 by 9 inches. Published by the Philosophical Library, Inc., 15 E. 40th St., New York City. Price, $6.

This dictionary contains 10,000 current terms in the English language most frequently used in the physical sciences and their applied fields, together with separate indices in French, German, and Spanish, conversion tables, and technical abbreviations. It is the outgrowth of ten years of experience in teaching the reading and translation of scientific and technical material in foreign languages to the students of a polytechnic institute. The aim has been to produce a dictionary that is up to date, particularly in the fields of aeronautics and radio.

ESSENTIALS OF DRAFTING. By Carl Lars Svensen. 295 pages, 7 by 9 1/2 inches; profusely illustrated. Published by the D. Van Nostrand Co., Inc., 250 Fourth Ave., New York City. Price, $2.35.

This is the third edition of a book that was originally published several years ago; the entire text, however, has been rewritten and rearranged to bring it in line with the best current practice. New illustrations and new problems have been provided. Where necessary, the text conforms with the standards adopted by the American Standards Association. The large size page permits the presentation of clearer illustrations and of problem material that would have been difficult to present on a smaller page.

BLUEPRINT READING. By D. E. Hobart. 58 pages, 8 1/4 by 10 3/4 inches; numerous charts. Published by Harper & Brothers, 49 E. 33rd St., New York City. Price, $1.

The author of this book, who is associate professor of mechanism and engineering drawing at the University of Michigan, has embodied in this course his own experience in teaching the reading of machine drawings at the General Motors Institute, where men taking courses in machine shop practice are required to work from drawings in the machining of their practice exercises. A trial of several methods appears to the author to indicate that the method used in this text-book makes it possible to teach the interpretation of working drawings to beginners quickly and effectively.

ELECTRONIC CONTROL OF RESISTANCE WELDING. By George M. Chute. 389 pages, 6 by 9 inches. Published by the McGraw-Hill Book Co., Inc., 330 W. 42nd St., New York City. Price, $4.

The author, who is application engineer, General Electric Co., has presented in this book a most complete treatment of the theory and practice of electronic resistance welding controls. While the book deals with the subject in a very thorough manner for the engineer who wishes to go deeply into the theory, it also contains simple explanations of tubes and circuits for those who need a basic introduction to electronics without going into technical detail.

PRACTICAL WOOD PATTERNMAKING. By J. Robert Hall. 188 pages, 8 1/2 by 11 inches. Published by the McGraw-Hill Book Co., Inc., 330 W. 42nd St., New York City. Price, $3.

The purpose of this text-book is to prepare the student to become a skilled patternmaker in the shortest possible time. It is designed for use in vocational or technical schools and in apprenticeship training. The instructions proceed step by step from blueprint reading to the construction of simple patterns, and then more complicated ones. Many blueprints have been included to provide ample practice material.

FUNDAMENTALS OF MACHINES FOR THOSE PREPARING FOR WAR SERVICE. By Glenn M. Hobbs, L. H. Morrison, and Ray F. Kuns. 294 pages, 5 1/2 by 8 1/2 inches. Published by the American Technical Society, Drexel Ave. at 58th St., Chicago, Ill. Price, $2.

Because of the variety of subjects covered in this book, its contents can be most easily understood from the following list of chapter headings: Practical Physics; Blocks and Tackle; Automobile Design and Construction; Automobile Engines; Automobile Engine Troubles; Aircraft Engines; Diesel Engines—Operation and Maintenance; and Tables.

INDEX TO A S T M STANDARDS (Including Tentative Standards). 198 pages, 6 by 9 inches. Published by the American Society for Testing Materials, 260 S. Broad St., Philadelphia, Pa.

This publication is an adjunct to the 1942 "Book of Standards" of the American Society for Testing Materials, and enables any of the 1100 standard specifications and tests to be located readily. The Index is furnished without charge to those interested.

TABLES OF DATA ON CHEMICAL COMPOSITIONS, PHYSICAL AND MECHANICAL PROPERTIES OF WROUGHT CORROSION-RESISTING AND HEAT-RESISTING CHROMIUM AND CHROMIUM-NICKEL STEELS. Prepared by Russell Franks and Francis L. LaQue. 43 pages, 6 by 9 inches. Published by the American Society for Testing Materials, 260 S. Broad St., Philadelphia, Pa. Price, $1.25.

WAYS OF DEALING WITH ABSENTEEISM AS PART OF THE WAR PRODUCTION DRIVE—A Guide for Plant Labor-Management Production Committees. 27 pages, 5½ by 7½ inches. Published by the War Production Drive Headquarters, War Production Board, Washington, D. C.

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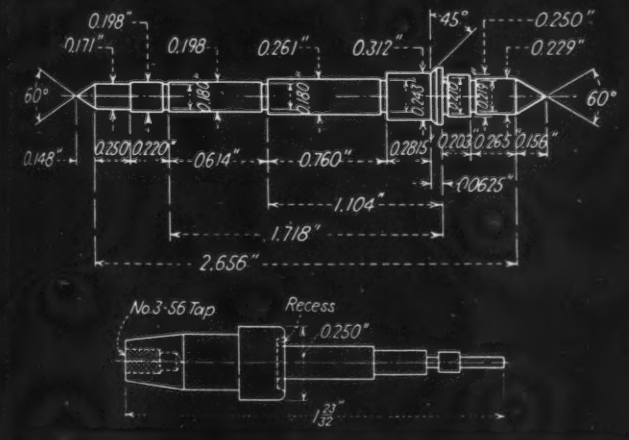

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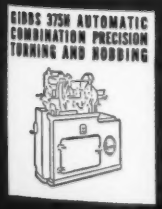

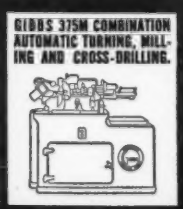

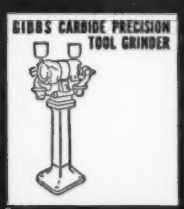

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